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Social Inequalities in Access to Child Healthcare Services:
An International Comparative Perspective

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Dedicated to my grandpa Canko and my Ayteyze

Canko Dedem'e ve Ayteyzem'e

ABSTRACT

Universal access to child healthcare services is of greatest importance and a common goal of many countries in Europe and elsewhere. Thus, every child should be able to receive the healthcare they need, irrespective of their socio-economic circumstances and national origin. To what degree this is the case is the subject of this thesis.

This thesis examines social patterns of access to child healthcare services and, furthermore, evaluates social inequalities in relation to structural and organizational differences in child healthcare systems at national levels. In particular, the studies use different indicators of access to child healthcare services, focusing on the three levels of preventive care: primary, secondary, and tertiary. The thesis draws on national register data from several countries and uses an international comparative perspective on social inequalities in child healthcare services.

Studies I, II, and III analyzed primary-level prevention, focusing on the social distribution of Measles-Mumps-Rubella (MMR) and/or Diphtheria-Tetanus-Pertussis (DTP) vaccination uptake among children. The results from Study I, a systematic review, revealed different levels of inequalities across European countries and Australia. A comparison of healthcare systems showed that countries that have well-baby clinics and have a hierarchical primary healthcare service structure tend to be more equitable. The results from Study II supported the findings about well-baby clinics in Study I. A comparison between four Nordic countries revealed the lowest vaccination levels and the highest social inequalities in Denmark. Considering that the healthcare systems among these Nordic countries are very similar, the absence of well-baby clinics stands out as a possible explanation for the observed difference in inequalities. Study III examined trends in the social distribution of MMR vaccination coverage in two Australian states (New South Wales and Western Australia). The results showed increasing inequalities among children with a migrant background in both states and persisting but diminishing inequalities for Aboriginal children, especially in Western Australia. Ambitious immunization policies and strategic interventions towards the Aboriginal population could plausibly explain the decreasing inequalities in New South Wales.

Study IV analyzed secondary prevention, focusing on the social distribution of the timing of orchidopexy (surgery for undescended testicles) among children before and after new European guidelines recommending the surgery to be performed before the age of 1. Based on a comparison between five jurisdictions, the results showed both absolute and relative increases in overall inequalities in surgeries before the age of 1.

Study V looked at the social distribution of ADHD medication uptake among children in Sweden. A comparison between children of parents with a migrant background and children of Swedish-born parents showed lower ADHD medication uptake among children of parents from low- and middle-income non-European countries.

In summary, using an international comparative perspective and combining a systematic review with empirical registry studies, the thesis shows persisting inequalities in the uptake of child healthcare services. Furthermore, the magnitude of social inequalities vary between countries with different structure and organization of child healthcare services. These findings indicate the potential of a more equitable healthcare system and points to the need to reform child healthcare services in welfare states.

CONTENTS

LIST OF SCIENTIFIC PAPERS

I. **Arat A,** Burström B, Östberg V, Hjern A. Social inequities in vaccination coverage among infants and pre-school children in Europe and Australia – a systematic review. BMC Public Health, 2019, 19:290.

II. **Arat A**, Norredam M, Baum U, Jónsson SF, Gunlaugsson G, Wallby T, Hjern A. Organisation of preventive child health services: Key to socio-economic equity in vaccine uptake? Scandinavian Journal of Public Health, 2019.

III. **Arat A**, Moore H, Goldfeld S, Östberg V, Vicky Sheppeard, Hjern A and Gidding H. Childhood immunization coverage in Australia: An equity perspective. (Manuscript)

IV. Jay MA, **Arat A**, Wijlaars L, Ajetunmobi O, Fitzpatrick T, Lu H, Lei S, Skerritt C, Goldfeld S, Gissler M, Gunnlaugsson G, Jónsson SF, Hjern A, Guttmann A, Gilbert R. Timing of paediatric orchidopexy in universal healthcare systems: an international administrative data cohort study. (Submitted)

V. **Arat A,** Östberg V, Burström B, Hjern A. ADHD medication in offspring of immigrants - does the income level of the country of parental origin matter? BMC Psychiatry, 2018, 18:3

LIST OF ABBREVIATIONS

ADHD	Attention deficit hyperactivity disorder
AIR	Australian Immunisation Register
ARIA	Accessibility Remoteness Index of Australia
CCI	Canadian Classification of Health Interventions
DTP	Diphtheria Tetanus Pertussis
EEA	European Economic Area
EFTA	European Free Trade Association
ICD-10	International Classification of Disease–10
IRSAD	Index of Relative Socio-Economic Advantage and Disadvantage
MMR	Measles Mumps Rubella
MMR1	First dose of Measles Mumps Rubella vaccination
MOCHA	Models of Child Healthcare Appraised
NOMESCO-v1.15	Nordic Medical-Statistical Community classification of surgical procedure-version 1.15
NSW	New South Wales
OPCS-4	Office of Population Censuses and Surveys classification of interventions and procedure version 4
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SBM	Social Behavioural Model
WA	Western Australia
WBC	Well-Baby Clinic

1
Introduction

Being in the best achievable state of health is a fundamental human right for everyone (1), but children are an especially vulnerable population who require special attention. According to the 1990 UN Convention of the Rights of the Child, children ought to enjoy "the highest attainable standard of health", irrespective of their socio-economic circumstances, national or social origin, gender, or religion. Such health equity can be achieved in part by ensuring that "no child is deprived of his or her right of access to…health care services"(2).

Access to child healthcare services is important not only for children's personal well-being, but also for the well-being of society at large. Childhood vaccinations are a good example of how preventive healthcare at an individual level has broader implications on a population level. It is only by vaccinating individual children that herd immunity can be reached, which is essential for preventing the spread of disease. Access to child healthcare services is therefore not only a human right, but also a public health goal.

Access to child healthcare services also has both short- and long-term implications for individuals (3). This is true for numerous services such as screening for early recognition of malformations and providing medication and rehabilitation for minimizing the negative consequences of symptomatic diseases. This means that equal access to child healthcare services is of relevance for reducing health inequalities in both the present and the future – for children and, later on in life, for adults.

The most obvious way to provide equitable access to child healthcare services is to ensure universal accessibility, which aims to remove economic barriers for parents. However, even in countries that have universal accessibility, not all children access healthcare services equitably in every national healthcare system. There are, in fact, deep-seated social inequalities in access to child healthcare services (4). The existence and extent of these social inequalities vary from country to country, depending in part on the structure and organization of their healthcare system as well as policies around healthcare.

Previous studies have addressed these social inequalities in access by focusing primarily on immediate factors such as doctor-patient relationships, parental reminder systems, and individual motivations for health-seeking behaviours (5). While such studies are valuable for highlighting downstream determinants, they risk overlooking more structural explanations for the social distribution of access to child healthcare services.

This thesis analyzes social inequalities in access to child healthcare services, drawing on studies on vaccinations (i.e. MMR vaccination), early detection and correction of malformations (i.e. orchidopexy), and mental healthcare services (i.e. ADHD medication). The twofold focus of the thesis is 1) to study and increase the understanding of social patterns of access to child healthcare services and 2) to evaluate patterns in light of structural and organizational differences in child healthcare systems at national levels. The thesis has an international comparative perspective, based on the analysis of national register data from several countries.

2
Background

2.1 Social inequalities in health

Social inequalities[1] in health can be defined as the "systematic differences in one or more aspects of health status across socially, demographically, or geographically defined population groups" (p. 452) (7). Social inequalities in health are systematically produced and can potentially be altered by government policies and other changes within institutional structures, such as educational systems, labour markets, and healthcare services. These differences are unfair and discriminatory, contravening human rights and raising serious concerns for public health (8). To fully understand the mechanisms of social inequalities in health, we first need to consider how social groups are formed and defined.

Children are born into a complex web of social circumstances. These social circumstances partly reflect the social positions of parents. Parental social position is made up of multiple dimensions such as socio-economic status, national origin, and area of residence, all of which play a role in shaping a child's life trajectory. Thus, alongside other social- and individual-level determinants, parental social position is crucial for the child's development and well-being across the life course.

In health inequality research, the socio-economic status of an individual is usually defined by educational level, occupational class, or income level (9). These three measures of socio-economic status are all linked to social standing and prestige. They are also linked to resources vital for an individual's ability to create and control their own and their family's living circumstances. Due to this, inequalities in health are produced both among parents and their children. Although these three ways of measuring socio-economic status are highly correlated, they also provide

[1] The term "inequities" in health implies a distinction between *acceptable* differences in health status between individuals due to biological factors (e.g. age, sex) and *unacceptable* differences due to socio-economic factors (e.g. income, education, occupation). However, the terms "social inequities" and "social inequalities" in health are used interchangeably across international health documents. This thesis will therefore use these terms synonymously (6).

insight into different and more specific social mechanisms. Educational level is one of the strongest determinants of an individual's chances and opportunities in life. It is closely linked to one's occupational prospects and income. Having a higher level of education provides a higher status in society. It opens up doors to more possibilities in life, enables better access to the job market, facilitates more informed decisions, increases health literacy, and improves reasoning skills (9). Education is strongly associated with mortality and other health outcomes (10), including the health of children (11).

Another dimension of social position is national origin. Having parents with a migrant background, as opposed to being born to a family that has the background of the majority of the population, affects the child's chances in life. Migrant background and socio-economic position are highly intertwined dimensions, with complex combinations. Migrants form a large and heterogeneous group that includes people from a variety of countries with different reasons for emigrating and different social-economic statuses in their country of origin. However, migrants in Sweden often belong to more disadvantaged socio-economic groups due to barriers in access to the job market, lower incomes, and working in low status occupations (12). This in turn leads to inequalities in social and economic capital, in prestige and status, and in opportunities and choices. Furthermore, other factors – including discrimination, migration stress (both prior to as well as during the stay in the country of arrival), the hardship of adapting to different social rules and a new language, and a lack of knowledge about the structures in the host country – further amplify these inequalities (12, 13).

Among migrants, the influence of the above-mentioned social factors on health outcomes has been explored through a health literacy framework. Health literacy refers to an individual's knowledge about health and healthcare services as well as a comprehensive understanding of health information (14). Studies have shown health literacy to be an important determinant for the observed social inequalities in health among migrants (15), a topic we will discuss in more detail in section 2.2.1.

Health outcomes among migrants is, however, controversial. While some studies find children of migrant parents to have worse health outcomes compared to the local population (16), other studies find children of migrant parents to have a similar, and sometimes better, health compared to the local population (17-19). The better health outcomes of children of migrant parents, despite the possible disadvantages faced in the host country, is often called the "healthy migrant paradox" (20)**.** The country of origin, the health outcome under question, health selection, the reason for migration, and the length or residence in the host country are some of the possible explanations for this phenomenon (21, 22).

Gender is another dimension that determines the social position among both parents and their children. Gender inequalities are closely linked to socio-economic inequalities due to the presence of gender discrimination in educational systems as well as the labour market, leading to inequalities in opportunities and chances in life. Children also face different expectations and attitudes from their parents and health professionals depending on their gender (23); and a referral bias in healthcare services (24, 25). This in turn might affect how one views and decides on the health status of a child, which further contributes to inequalities.

Capabilities theory, proposed by Amartya Sen (26, 27), explores the pathway between social position and inequalities in health. In its simplest form, the theory suggests that in the current socio-political context, our social position (determined by multiple factors such as educational level, income, national origin, gender, etc.) shapes our *functionings* and *capabilities*. Functionings refer to "doings" and "beings". Examples of "doings" are working, traveling, and voting, while examples of "beings" are being healthy, being well-nourished, and being educated. Capabilities are described as real opportunities and valuable options that an individual has at their disposal to be able to attain these functionings. Social inequalities in capabilities thus lead to health inequalities that are unjust. The unequal distribution of capabilities can be reduced by ensuring equitable access to social institutions. This thesis argues that one such institution is healthcare services.

2.2 Social inequalities in access to child healthcare

Despite its potential to have immediate effects on the health outcomes of individuals, the role of healthcare services as a determinant of inequalities in health has been challenged. For example, Margaret Whitehead stated that "inadequate access to health services is only one of many determinants of the observed inequalities in health, and a relatively minor one at that" (p.77) (28). Similarly, a recent study based on thirty systematic reviews claimed that healthcare is not one of the primary social determinants of health (29).

Even though the power of healthcare services might be limited compared to other determinants, equity in access to healthcare services is of great importance in its own right. The UN Convention of the Rights of the Child (2) asserts that children ought to have the right to the highest achievable standard of health and to healthcare services, emphasizing the necessity for effective primary healthcare. Primary care, and especially preventive care, is unique in its capacity to alleviate or exacerbate observed inequities in health. For example, by focusing on underprivileged groups, preventive care has the potential to reduce the effects of social disadvantages and therefore reduce inequities in health outcomes (30, 31).

The mediating role of access to healthcare is especially important with respect to child health. A report published by WHO's Commission on Social Determinants of Health (3) argued that equity during early childhood is a powerful equalizer across the life course of individuals where the healthcare system plays a crucial role, serving as "the point of first contact and can serve as a gateway to other early childhood services" (p.5).

While Amartya Sen's theory focuses on the relation between social inequalities and health outcomes, the following two sub-sections will examine social determinants of access to health care. Sen's theory is useful for exploring capabilities that lead to health outcomes, but it downplays the mediating role of access to healthcare services. This runs the risk of overlooking important social mechanisms that give rise to inequalities in health, a topic to which we now turn.

2.2.1 Social theories of access to healthcare services

Children are a vulnerable population that does not have much control over their choices when it comes to the uptake of healthcare services. It is rather the parents who take the decisions on the child's behalf. Since uptake of healthcare is socially distributed, it is therefore relevant to assume that parental social position could influence the child's access to healthcare services.

The determinants of access to healthcare have been the focus of many social theories (32). One theory that integrates institutional, structural, social, and individual determinants of access to healthcare is the social behavioural model (SBM) by Aday and Andersen (33). The model provides insight into possible pathways between social determinants and access to healthcare. The factors that influence access to care are twofold: predisposing and enabling. Educational background, one of the predisposing factors that is explored in this model, is said to have an impact on the individual's health-seeking patterns by expanding social and capital resources as well as improving the individual's life chances (34). This association is also supported by health literacy, which is defined as "[…] people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course" (14). The term "health literacy" was initially used to concentrate solely on personal abilities. However, the discourse around health literacy expanded over the years and now recognizes social determinants as part of the equation (35). Recent studies have found that people in more socially disadvantaged groups have lower health literacy (36) and consequently lower access to preventive healthcare services (37, 38). Interestingly, the positive correlation between education, health literacy, and access to healthcare

found in previous studies is contradicted by the appeal of the anti-vaccination movement among highly educated parents (39).

Another predisposing factor is health beliefs, which are shaped by values around health, attitudes towards health services, and knowledge about diseases. An example of the role of health beliefs is seen among some parents from anthroposophic communities, who claim that vaccine-preventable diseases provide "natural immunity" and therefore strengthen the body (40). Other examples include the low vaccination levels among children of parents with certain religious beliefs (41) and children of parents from certain ethnic groups (42, 43). A national report in Sweden investigated the reasons behind an especially low level of vaccination coverage among children of Somalian parents. The report found misinformation about the side-effects of the MMR vaccination (i.e. causing autism) to be the main explanation behind these low levels (44). Health beliefs also influence health-seeking patterns of behaviour, especially in relation to mental health. Western psychiatry has a considerable impact on how psychological distress and behavioural problems are conceptualized in high-income countries, while low-income countries without much presence of Western psychiatry rely more on traditional culture-specific beliefs in these matters (45). Migrants who live in high-income countries who have a background in low- or middle-income countries thus sometimes rely on alternative ways of dealing with mental health problems instead of seeking psychiatric care and treatment with psychotropic drugs (46, 47). In addition, some migrant parents may also worry about the social stigma attached to mental illness and thus may delay seeking medical help for such conditions (48). This makes it difficult to interpret consumption patterns of mental health for population groups with an origin in low- and middle-income countries. It is thus difficult to know whether the lower consumption should be interpreted as lower access or as a healthcare-seeking pattern of behaviour.

In the social behavioural model (SBM) by Aday and Andersen, income level is taken as an enabling factor, especially in systems where co-payments are required for the services and health insurance is mainly provided by private institutions. As an enabling factor, income influences the perceived cost-effectiveness of the services, which is partly shaped by educational level and health literacy.

The SBM, however, has limitations that need to be acknowledged. The model assumes that all individuals have a long-term preventive approach to their health. However, the model does not take into account the fact that individuals may have a short-term curative approach to their health (49). Overlooking this could lead us to misunderstand patterns of behaviours in healthcare uptake. A second limitation of the theory is that SBM focuses solely on individuals and downplays the importance of the social network in which they are located. The Social Organisation Strategy (SOS), developed by Pescosolido and colleagues, argues that the social network

plays a more prominent role in the decision process of an individual over and above socio-economic and demographic factors (50). Aday and Andersen's model also lacks a patient-oriented focus (49), which limits understanding of the pathway from social position to healthcare uptake. For example, the SBM does not address the possible social inequalities that may arise in doctor-patient relations due to discrimination or miscommunication. Finally, the SBM makes a strict distinction between predisposing and enabling factors when, in fact, they may overlap to some extent. This division is problematic because these indicators of social position are highly correlated. For example, it is difficult to separate the enabling factor of income from the predisposing factor of education when the level of the latter may affect the level of the former.

Despite its limitations, the SBM provides a comprehensive model that aids research into linkages between social determinants and access to healthcare. The pathways that are explored in SOS and patient-oriented theories are implied to some extent within the SBM, not least because both social networks and patient experiences can be influenced by predisposing and enabling factors. For example, parents who are employed can receive guidance and help from their colleagues at work whereas an unemployed parent might not have access to these types of social network resources. The SBM therefore allows us to focus on both the broader social and institutional context and individual-level patterns of behaviour and life experiences.

2.2.2 Defining and measuring inequalities in access to healthcare services

The studies included in this thesis are examples of child healthcare services provided in preventive care, which is the focus of this section.

In contrast to curative care, which provides treatment for an illness in order to cure it, preventive care aims at preventing the occurrence and progression of a disease as well as minimizing its negative effects on an individual's life quality. There are three forms of preventive care: primary, secondary, and tertiary. Primary prevention provides preventive and health promoting services. These services, among others, include vaccinations, provision of information on healthy behaviours, and parental support services to guide the parents' in their parenting skills (51, 52). Secondary prevention refers to screening services that enable the early recognition of malformations and developmental delays as well as early interventions to stop the progression of a disease. With this, secondary prevention aims to prevent future complications from the condition. Tertiary prevention includes services that seek to minimize the negative effects of a symptomatic disease for an individual. An example of this is the control of symptoms through medication or rehabilitation (53).

Preventive care is provided within all three levels of healthcare: primary, secondary, and tertiary. Primary care is the first point of access to healthcare services that does not require referrals. Depending on the country, primary care is provided by a variety of healthcare professionals and in a wide range of settings. Secondary and tertiary care are, in most cases, accessed through a referral system and are provided by specialized teams of healthcare professionals (54).

A successful healthcare system should not only be fully equipped to function well at all levels and across all services, but its services should also reach everyone in the population. In other words, a healthcare system needs to have universal coverage and accessibility. Access to care has two main components: service availability and uptake of healthcare (49). Previous literature does not make a distinction between these two components, using the term "access" interchangeably to refer to both. This creates an ambiguity around the concept of "access". Service availability refers to the presence of services whenever they are needed or demanded. In other words, service availability revolves around the potential of service provision. It is typically measured with indicators such as the number of doctors or hospitals per unit population, the cost of services for the patients, and the presence of healthcare units in a defined geographical area. Uptake of healthcare, meanwhile, refers to an individual entering and experiencing healthcare services. Uptake of healthcare is measured by diagnoses, medication uptake, vaccination uptake, the use of services such as visits to a nurse or doctor, or attending scheduled check-ups (49). It is important to differentiate between the two components since they can provide different pictures of a healthcare system. For example, free healthcare services might be available for a child, but the parents might not utilize the services due to a lack of knowledge or awareness of the healthcare system. In this case, to evaluate access to healthcare, it would be crucial to study the uptake of the services rather than solely examining the service availability. In this thesis, I use the terms "uptake" and "access" as synonyms.

Equality in access to healthcare needs to be considered on two axes: horizontal and vertical. Horizontal equality strives for equal access to healthcare for individuals with equal needs, which is commonly assessed by service availability, service utilization, and healthcare outcomes. Vertical equality, meanwhile, strives for "unequal" access to healthcare for individuals with unequal needs, i.e. appropriate to their level of need (55). It is less relevant to determine the level of need for understanding inequalities in preventive care since all children have the same need for such services, such as being immunized, being screened for early detection of diseases, and receiving medication for minimizing the negative consequences of symptomatic diseases. The studies in this thesis therefore focus on horizontal equity.

In this thesis, three indicators are used to measure the uptake of child healthcare services in relation to social inequalities, each belonging to one of the three forms of preventive care: primary, secondary, and tertiary. First, the social distribution of MMR vaccination levels is used as an indicator of social inequalities in the uptake of primary prevention, since the need for immunization is the same across all social groups. Second, the social distribution of the correction rates of undescended testicles (cryptorchidism) is used as an indicator of social inequalities in the uptake of secondary prevention. Cryptorchidism is corrected by a surgical procedure called orchidopexy, which involves moving an undescended testicle into the scrotum (56). Orchidopexy is an appropriate indicator to evaluate inequalities in access to child healthcare services because the occurrence of undescended testicles is not known to be associated with social position (57-59). Third, the social distribution of ADHD medication levels among migrants and non-migrants is used as an indicator of social inequalities in the uptake of tertiary prevention. According to at least two studies (60, 61), the occurrence of ADHD is similar among migrants and non-migrants. This makes the social distribution of ADHD medication levels a suitable indicator to measure inequalities. While the use of ADHD medication can be seen as a "curative service", it can also be viewed as tertiary prevention because it aims to improve the child's functioning in society by controlling the symptoms of ADHD, rather than curing the condition (62, 63). The three indicators are important from a life-course perspective since vaccinations, screenings, and medications improve not only the child's health in the present, but also their future health as an adult.

2.3 Structure and organization of healthcare services

Policies that target the provision, structure, and organization of healthcare services have the power to influence the pathway from parental social position to a child's access to healthcare services. This is illustrated by Diderichsen and Hallqvist's framework (64), which, among other things, explains how healthcare-related policy interventions could affect the pathway from social position to health outcomes. With regards to healthcare services, this framework focuses on the role of curative services with an emphasis on the role of secondary and tertiary care. However, it focuses less on the role of primary care services. The framework also downplays the way that equitable preventive healthcare across all levels of care could mitigate the negative impact of social position on health outcomes.

Recent attempts have been made to address what it means for healthcare services to be equitable and what can be done to achieve this goal. For example, the Marmot review (8) recommends tackling inequities not by targeting the disadvantaged but through provision of universal services that are proportionate in their level to the intensity of disadvantage. This concept of "proportionate universalism" has

been applied in a recent intervention project concerning postnatal services for the first-time parents in a socially disadvantaged area called Rinkeby, in Stockholm, Sweden (65). Results showed increase in levels of vaccination coverage and decrease in acute service uptake: a convergence towards the levels in the socially advantaged areas (66, 67).

To understand the potential of primary care and preventive services to tackle child health inequalities, I will first outline the structural and organizational factors within the healthcare system. I will then discuss the influence of these structural and organizational factors on the social distribution of healthcare uptake. In other words, I will try to answer the question: in what ways could the structural and organizational factors of child healthcare services have an impact on parents' possibilities in accessing services?

There are both similarities and differences in primary care models across countries. In most European countries and in Australia, the primary care physician is the first contact in the healthcare system and the focal point of primary care provision, responsible for the coordination of the care of individuals. Furthermore, most of these countries seek to keep co-payments low and provide universal access to primary care services (68)

Two key aspects that differ across countries in relation to the organization of primary care is the role of the state in providing, regulating, and financing the services as well as the freedom of professionals within primary care. In an attempt to classify the organization of primary care services with respect to these two aspects, Bourgueil et al. (69) suggested two main models: hierarchical and non-hierarchical. Based on this classification, primary care services that are hierarchically structured rely on de-centralized state authorities for provision, regulation, and financing. Examples of countries with a hierarchical model of primary care include Spain, Sweden, the Netherlands, and the United Kingdom. Primary care services with a non-hierarchical model, meanwhile, are composed of different modes of organization, a predominance of solo practitioners, and a low number of healthcare centres that specifically target disadvantaged populations. In this model, self-employed primary care practitioners have the freedom to choose where to establish their practice and the state has minimal control over the provision, regulation, and financing of the services provided. Examples of countries with a non-hierarchical model of primary care include France, Germany, and Austria.

This classification is, however, changing due to on-going healthcare reforms across Europe, such as in Spain, Sweden, and United Kingdom. One major shift in the organization of primary care in these countries is the increased freedom for healthcare professionals in establishing outpatient clinics at locations of their choice. A recent evaluation of this choice reform in primary care in Sweden

showed that this shift led to an increase in access to primary care for advantaged populations compared to disadvantaged populations who suffer from poor mental health, poor self-rated health, and limiting long-standing illnesses (70). The possible effects of these reforms on inequalities in access to healthcare need to be taken into consideration when comparing different systems.

Another factor that differs between the national models of primary care is the organization of preventive services. In Sweden, Finland, the Netherlands, Belgium, Iceland, Norway, and Australia, there is a special organization called "well-baby clinics" (WBC), which focuses on the youngest individuals in the population. These clinics focus solely on young children's health and are led by public health nurses who work within a team of other child health professionals. In countries that do not have these clinics, preventive services for children are integrated into regular primary care, often with general practitioners as the main point of contact. In Sweden, WBCs are one of the most important factors in achieving low infant mortality rates and high overall well-being of children (71). With services delivered free-of-charge and a focus on the needs of the child, WBCs provide health promoting services such as giving advice and support to parents in parenting, breast feeding methods, and increasing the efficiency of the communication between healthcare personnel and parents (51). They also provide preventive services such as vaccination as well as early identification of deviations from normal development, which in turn allows for referrals to specialist care and treatment (72). WBCs use a parental call system to notify and/or remind the parents about their scheduled meeting with healthcare personnel. This parental call system is important because it minimizes the dependence on parental knowledge of the healthcare system and the parents' self-initiative to visit the well-baby clinic. Due to its child-focused and community-oriented approach, WBCs have the potential to form trusting relationships with parents and provide the needed assistance to those with greater disadvantage (51). A comparison of inequalities in uptake of preventive services across countries with different preventive care organizations can identify areas where changes should be made to tackle inequalities more effectively.

In recent years, one of the most heated discussions with regards to access to care is how to increase vertical integration between the three levels of healthcare services (73, 74), that is, achieving a smoother referral between primary, secondary, and tertiary care services. Vertically integrating care requires continuous communication between healthcare providers, specifically by sharing data bases where the medical history of patients is accessible to all healthcare providers. The level of vertical integration differs considerably across countries (54, 75). One can hypothesize that increased vertical integration could improve a patient's ability to navigate within the healthcare system, which could lead to faster access to healthcare services and less waiting times between levels of care.

Starfield's four quality criteria can be used as a framework to understand how the above described structural and organizational factors of healthcare services influence the everyday life of parents. These four quality criteria focus on access, longitudinality, comprehensiveness, and coordination of healthcare services in a primary care setting (76). Well-baby clinics provide a platform for the provision of services in accordance with all these four quality criteria. Firstly, well-baby clinics facilitate easy access to healthcare services by being the first point of contact for the child's healthcare needs since parents are assigned to a clinic automatically, without having to self-register. In addition, the parental call system ensures that parents are contacted by the well-baby clinic, rather than the other way around. This serves to both reduce the dependence on parents' own knowledge about how the healthcare system works and minimize the reliance on parents' own initiative to access healthcare services. Secondly, services are provided by the same nurse on repeated visits, which means that the health status and development of the child is followed from the neonatal period until school entry. This leads to continuity of care and thereby an increased potential for forming a trustful relationship between the care provider and the child's family. Trust in healthcare providers is positively associated with vaccination uptake (39, 44, 77). Well-baby clinics also offer a comprehensive platform for various preventive services such as vaccination, early recognition of malformations and developmental delays, health promotion, and parental support. Finally, referral to other levels of care in well-baby clinics is more coordinated and methodical, as opposed to healthcare service organizations where services are provided in a fragmented way.

In summary, structural and organizational factors that make access to healthcare services less dependent on the individual's resources and capabilities are most likely to produce equality in uptake of services.

In light of the above argument, Figure 2.1 summarizes the pathways that are explored in the studies in this thesis. In particular, it represents, in outline form, 1) the association between parental social position and access to child healthcare services, that is social inequalities in access to healthcare (and in turn health outcomes) 2) the potential impact of the structure and organization of healthcare systems, as well as health policies, on social inequalities in access to healthcare.

2.4 Contribution of the thesis

The majority of the studies on social inequalities in access to healthcare services focus on the adult population. However, children are a vulnerable population that deserve special attention. Every child has the right to equitable access to healthcare services, which is unfortunately not fully attained in the current global context. One crucial step to rectify this is to increase our understanding

of social inequalities and to examine the role of governmental structures such as healthcare systems. This thesis therefore seeks to understand the pathways from parental social-economic status to child healthcare uptake and to understand how the organization and structure of healthcare systems influence these pathways.

In the literature on social determinants of health inequalities, access to healthcare services is often said to have a minor role. In studies that acknowledge the importance of healthcare services, the focus is largely on curative rather than preventive care. This thesis adds to the literature by bringing preventive care into the picture.

The empirical studies in this thesis are based on registry data and employ a comparative approach. The comparisons concern mainly countries and regions. The social inequalities in access to healthcare services are investigated from multiple angles. In particular, the studies analyze different dimensions of parental social position – such as income, education, occupation, and national origin – in relation to a range of indicators of access to child healthcare services. This is important for understanding the social factors that enable some children to receive necessary healthcare services, while impeding other children from doing so. In this way, we can identify areas for possible policy intervention in order to achieve a more equitable healthcare system.

The included studies cover primary, secondary and tertiary prevention. However, three out of five studies in this thesis focus on social inequalities in primary prevention, namely vaccination uptake. Previous studies on vaccination levels attribute the recent decline in coverage to parental vaccine hesitancy. While recognizing this problem, this thesis argues that there are other aspects that we also need to take into consideration when dealing with this issue, such as the social inequalities in vaccination levels. For example, Study III provides an insight into the increasing social inequalities in vaccination coverage over a nine-year period in Australia. In addition, previous studies focus on immediate factors within a country's healthcare services, such as reminder systems for parents, the role of local communities, and the relationship between healthcare providers and parents. This thesis takes a broader approach and examines how the structure and organization of healthcare systems at a national level might influence the uptake of services at an individual level. In particular, the thesis advances a classification of child healthcare services that divides child healthcare systems into 1) whether they have or do not have well-baby clinics and 2) whether they are hierarchical or non-hierarchical. Finally, whereas previous studies tend to examine a single country in their analysis, this thesis offers an international comparative perspective on access to healthcare services.

This thesis is part of a Horizon 2020 project within the European Commission entitled 'Models of Child Healthcare Appraised' (MOCHA). The results of the studies in this thesis were communicated to wider society at the European Union level to inform policy- and decision-makers responsible for child healthcare systems.

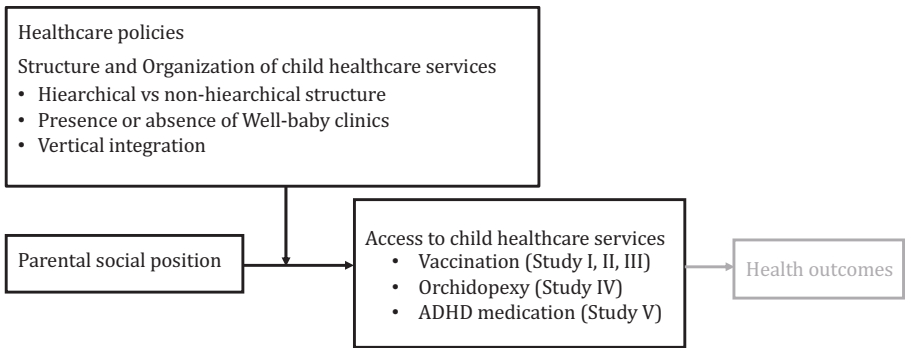


Fig 2.1 Outline of the pathways explored in the thesis.

3
Aims and research questions

Overall aims

The aims of this thesis are a) to identify social inequalities in access to child healthcare and b) to increase the understanding of how social inequalities in access to healthcare relate to the structure and organization of healthcare services.

Research Questions

Study I: Social inequities in vaccination coverage for MMR and/or DTP in Europe and Australia – a systematic review

a. What are the socio-economic patterns of vaccination coverage for infants and pre-school children in European countries and Australia?

b. Does the socio-economic patterning vary in accordance with structural and organizational differences in child primary care across the countries?

Study II: Social inequities in vaccination coverage for MMR in Nordic countries

a. Are there socio-economic differences in MMR vaccination coverage within the Nordic countries (Denmark, Finland, Iceland, and Sweden)?

b. Does the observed socio-economic distribution vary in accordance with the national organization of preventive healthcare services for children across the Nordic welfare states?

Study III: Social inequities in vaccination coverage for MMR in two Australian states

a. Are there socio-demographic differences in MMR vaccination coverage in Western Australia and New South Wales among children born between 2002 and 2011?

b. What are the MMR vaccination coverage trends within the socio-demographic groups and how do they compare between the two states?

Study IV: Social inequities in timing of paediatric orchidopexy in five jurisdictions

a. What was the proportion of orchidopexies performed by 1 and 3 years of age for birth cohorts between 2003 and 2011 in the five jurisdictions (England, Finland, Ontario [Canada], Scotland, and Sweden)?

b. What was the socio-economic distribution of orchidopexies before and after the introduction of new guidelines in 2008?

Study V: Social inequities in ADHD medication by parental country of origin in Sweden

a. Is there an association between the income level of the parental country of origin and levels of ADHD medication among children in Sweden?

b. To what extent is household income of relevance for this association?

4
Materials and methods

This chapter describes the data material, the indicators chosen to measure the variables, the methods, and the ethical aspects of this thesis. Sections 4.1 to 4.5 are summarized in Table 4.1.

4.1 Study design and data material

Study I is a systematic review of the existing empirical studies on socio-economic distribution of measles mumps rubella (MMR) and/or diphtheria tetanus pertussis (DTP) vaccinations among infants and pre-school children living in Europe and Australia. The data material was extracted from 15 studies from 11 countries, namely: the Netherlands, Sweden, Spain, Ireland, United Kingdom, Belgium, France, Germany, Greece, Italy, and Australia. Indicators of socio-economic status varied between the studies, which focused mainly on the role of parental education on vaccination uptake. The other indicators that the studies used were parental occupation, parental income, and area-level socio-economic status. Some studies included more than one socio-economic indicator in their analysis. Studies were tabulated and analyzed according to the structural and organizational features of the healthcare service of the country in question. These features comprised the presence or absence of well-baby clinics and whether the healthcare services have a hierarchical or non-hierarchical structure. The definition of these features was provided in section 2.3.

Studies II to V are empirical studies that use register data. Indicators of social position, vaccination uptake, orchidopexy procedure, and ADHD medication, as well as their respective sources, are shown in Table 4.2.

Studies II and III are cross-sectional studies that examine the social distribution of the first dose of measles mumps rubella (MMR1) coverage by two years of age in four Nordic countries and in two Australian states, respectively. In Study II, the data on vaccination were obtained from existing registers in Finland, Denmark, and Sweden. The dataset from Iceland was created specifically for this study. Indicators of socio-economic status and gender were obtained from national registers (see table 4.2 for details). Data material for Study III was previously

constructed by linking Australian Immunisation Register (AIR) to socio-economic and demographic information in perinatal and birth registers from Western Australia and New South Wales. The choice of these two states were due to the unique linkage capacity of their birth and perinatal registers to AIR. As instructed in the ethical permit, access to this data material was limited to the Australian research team and a file with aggregated data was made available for the purposes of this study.

Study IV is an international comparative study that explores the social distribution of the timing of orchidopexy (surgery for undescended testes) before and after the introduction of two European consensus statements. These consensus statements recommend surgery to be carried out between 6 and 12 months of age to prevent problems with fertility in adult age and to protect against malignancies associated with undescended testis (78, 79). Countries included in this study were England, Finland, Canada (Ontario), Scotland, and Sweden. The data sources of each country for the socio-economic indicators as well as the outcome measure are shown in Table 4.2.

The final study of the thesis is a cross-sectional study which examines social distribution of ADHD medication uptake in the year 2013 among children of ages between 4 and 18. Uptake of ADHD medication was defined as its purchase at least once during the year of interest. The main social determinant of interest was parental migrant background. Parental country of origin was stratified based on income level of the country of origin and whether the parents were European, non-European, Swedes, or mixed.

4.2 Study population

The systematic review (Study I) was part of a European Horizon 2020 project titled 'Models of Child Healthcare Appraised' (MOCHA). The choice of the countries included in the review was based on the participant countries in this project. The study focused on MMR/DTP vaccination uptake in children aged between 0 and 5 years old, who were living in one of the European Economic Area (EEA) countries, the European Free Trade Association (EFTA) countries, or Australia. When selecting articles, special attention was given to the size of the study population to ensure it was large enough to identify a 5% difference when stratified by social groups. Across the studies included in the review, population size varied from 630 to 180,456 individuals. The data collection spanned the period 1995 to 2012, with most of the individuals being born after the year 2000.

Studies II and III were based on all births recorded in national and regional registers. However, the year of birth varied within and across the two studies. In

Study II, Finland (N=58,525) and Iceland (N=4,323) provided data on births in 2013, whereas the birth cohorts from Sweden (N=35,767) and Denmark (N=3,396) were from 2009 and 2005 to 2008, respectively. Study III included all live births in New South Wales and Western Australia between 2002 and 2011 (N=1,174,150).

Study IV was based on all male singleton live births between 2003 and 2011 that survived until six months of age. The birth cohorts were obtained from the national registers of England (N=331,104), Finland (N=30,566), Canada (Ontario) (N=69,177), Scotland (N=28,099), and Sweden (N=54,400). The Finish data did not include the 2003 birth cohort.

In Study V the population consisted of children born in Sweden between 1995 and 2009 who were still residents of Sweden on 31 December 2012 (N=1,385,397).

4.3 Dimensions of inequality

In all the studies included in this thesis, socio-economic status and demographic indicators are used as the independent variables. Several social indicators such as parental education, parental occupation, household income, parental national origin, and area-level socio-economic disadvantage are explored in a number of studies. Aboriginal status, maternal age at birth, and remoteness are social indicators investigated only in Study III.

Most of the social indicators that are explored in the thesis are operationalized in a different way in each study due to differences in data availability across the countries. This diversity in the use of indicators was also observed across the studies included in our systematic review (Study I). Despite this, studies that investigated the role of one or more of the four indicators – parental income, parental education, parental occupation, and area-level socio-economic status – were included in the systematic review.

In Study II, the socio-economic distribution of MMR1 vaccination coverage was measured by household income in Sweden, Denmark, and Iceland and by maternal education in Finland. Distribution of the outcome was reported across income quintiles in Sweden and Iceland and across quartiles in Denmark. Maternal education in Finland was reported in five categories of education: upper secondary or less, lowest tertiary, lower-degree tertiary, higher-degree tertiary, and doctorate.

Study III explores the role of both socio-economic and demographic factors in MMR1 uptake. Within this thesis, Aboriginal status, maternal age at birth, and remoteness are the demographic factors that are specific to this study. Maternal age at birth was defined in five categories: younger than 20 years, 20-24, 25-29, 30-34, and 35 and older. Remoteness was measured by the Accessibility/Remoteness

Index of Australia (ARIA), which is based on road distance to services (80) and classified into five groups: major cities, inner regional, outer regional, remote, and very remote areas. Maternal country of birth was another socio-demographic factor of interest to this study. The data included Australia and ten other regions of origin, which were collapsed into a dichotomous variable of Australia vs non-Australia. Socio-economic status was measured by an area-level relative deprivation scale called the Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD), which includes information mainly on income, education, employment, and family status (81). The variable was divided into five groups where the lowest 10^{th} percentile and the highest 10^{th} percentile were defined as the most and the least disadvantaged, respectively. IRSAD and ARIA were based on the mother's residential address at the time of birth.

A relative deprivation index at neighbourhood-level was also used in Study IV for measuring socio-economic status in England, Canada (Ontario), and Scotland. The variable was presented in five groups. In the case of Finland, socio-economic status was measured by maternal occupation at birth and defined in four groups: upper white-collar, lower white-collar, blue-collar, and others including students and homemakers. Finally, in Sweden, disposable household income (in quintiles) was used as the socio-economic status indicator.

Study V focused on the role of parental country of birth in ADHD medication uptake in Sweden. Swedish children were defined as having both parents born in Sweden. Children with one Swedish and one foreign-born parent were categorized as "mixed". All other children were categorized based on maternal country of birth. The countries were grouped first as European and non-European and then as low, middle, or high-income (based on their gross national income per capita). Socio-economic status in Sweden was determined through disposable household income and was categorized in quintiles.

4.4 Indicators of healthcare uptake for children

In the thesis, child healthcare uptake is measured with three indicators: vaccination coverage, the timing of surgery for undescended testicles (orchidopexy), and ADHD medication retrieval, which are examples of primary, secondary and tertiary prevention services respectively.

The first three studies in the thesis focus on social disparities in vaccination coverage. The systematic review (Study I) included studies that analyzed MMR and/or DTP vaccination uptake by 5 years of age. Study II and III examined, more specifically, the first dose of MMR vaccination (MMR1) by 2 years of age in Nordic countries and in Australia, respectively.

Study IV focuses on social inequities in the timing of orchidopexy surgery. A case was defined as a child who was diagnosed with cryptorchidism and had a procedure code that indicated orchidopexy surgery before the age of 5. This cut-off point was chosen to reduce the risk of counting acquired ascending testes, which might occur later in childhood. Across all countries, cryptorchidism was coded according to the International Classification of Disease (ICD-10): Q53 (all subcodes), Q55.0, and Q55.1. Orchidopexy procedure codes varied between the countries. In England and Scotland, orchidopexy was coded as N08 and N09 (all sub-codes) within the coding system OPCS-4 (Office of Population Censuses and Surveys classification of interventions and procedure version 4). In Sweden and Finland, it was coded as KFH00, KFH10, and JAH01 within NOMESCO-v1.15 (Nordic Medical-Statistical Community classification of surgical procedure-version 1.15). Finally, in Ontario, the surgery data were based on the Canadian Classification of Health Interventions (CCI) and coded as 1QM74DA, 1QM74LA, and 1QM74LAKD.

In Study V, ADHD medication was defined as the first-time purchase of a drug with an anatomical therapeutic chemical code of N06BA01 to N06BA04 that was made at least once between 1 January 2013 and 30 June 2014. In order to avoid misclassifying the outcome, individuals with a narcolepsy diagnosis were excluded since they might take the same medication as children with ADHD.

4.5 Methods

In Study I, we followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (82) guidelines to carry out the systematic review. The PICO framework was used both in constructing the search string and in selecting the articles. We searched Pubmed, Embase, and Web of Science databases with a search string composed of three theme blocks: infants (population), socio-economic determinants (exposure), and vaccination (outcome). 8927 articles were scanned first by title and abstract and then by full text. A critical appraisal was carried out in order to ensure the quality of included articles, leading to a total of 15 studies for the final synthesis of the results (Figure 4.1). Analysis was done with a narrative approach due to the heterogeneity of socio-economic indicators across the studies included in the review. Results were presented in groups based on the type of primary care at national level. Four types of primary care models were constructed based on their structure (hierarchical vs. non-hierarchical system) and their organization (absence or presence well-baby clinics).

In Study II and III, MMR1 vaccination coverage was calculated by dividing the number of children that received the first dose of MMR (MMR1) before 2 years of age by the number of all live births in each birth cohort. Results were presented with 95% confidence intervals (CI). In Study III, the social distribution of MMR1

coverage was measured for each birth cohort from 2002 to 2011, which gave us the opportunity to observe the trends in vaccination levels.

The analysis in Study IV was carried out in four steps. Firstly, the cumulative incidence of orchidopexy by age of 5 for each birth cohort was plotted for all five countries. Secondly, we analyzed trends in the percentage of children receiving the operation before 1 and 3 years of age within each country. Thirdly, we measured social inequities in orchidopexy within each country by comparing the proportion of children receiving the operation in the highest three (in the case of Finland, the highest two) socio-economic groups to the proportion of children receiving the operation in the lowest two socio-economic groups. This ratio was defined as the inequity ratio. The analysis was done for children receiving the operation by 1 year of age and 3 years of age. Finally, to evaluate whether the introduction of guidelines changed social inequities in orchidopexy, inequity ratios were calculated for boys born between 2003 and 2006 compared to those born between 2008 and 2011.

In Study V, logistic regression analysis with 95% CI was carried out to calculate odds ratios for the retrieval of prescribed ADHD medication. The association between parental country of birth and the purchase of ADHD medication was analysed in two models. Model 1 included gender and the age of the child, and Model 2 included household income, family status and country of residence as well as gender and the age of the child. The moderating effect of household income was analyzed by stratifying the regression model by household income. A sensitivity analysis was performed to calculate odds ratios for ADHD diagnosis.

Table 4.1 Summary of studies

Study	Study Design	Study Population	Dimension of Inequality	Indicators of healthcare uptake	Methods
I	Systematic Review	Children between ages 0 and 5, living in the European Economic Area or European Free Trade Association countries and Australia.	- Area level SES - Parental income - Parental education - Parental occupation	MMR and/or DTP vaccine uptake by 5 years of age	Narrative synthesis
II	Cross-sectional	Denmark: Random sample of national cohort born between 2005-2008 (N=3396) Finland: Total national birth cohort in 2013 (N=58,525) Iceland: Total national cohort born in 2013 (N=4323) Sweden: Total regional cohort from Uppsala and Örebro, born in 2009 (N=35,767)	- Household income (Denmark, Iceland, Sweden) - Maternal education (Finland)	MMR1 vaccine uptake by 2 years of age.	Descriptive statistics
III	Cross-sectional	All live births in New South Wales and Western Australia between 2002-2011 (N= 1174150)	- Maternal country of birth - Aboriginal status - Maternal age at birth - Socioeconomic disadvantage - Remoteness	MMR1 vaccine uptake by 2 years of age.	Descriptive statistics
IV	Cross-sectional	Male singleton live births between 2003-2011 in England (N=331,104), Finland(N=30,566), Ontario(N=69,177), Scotland (N=28,099) and Sweden(N=54,400).	- Area level deprivation (England, Ontario, Scotland) - Household income (Sweden) - Maternal occupation (Finland)	Orchidopexy before 1 and 3 years of age	Descriptive statistics
V	Cross-sectional	Total national birth cohorts between 1995-2009 (N=1,385,397)	- Parental country of birth - Household income	Purchase of ADHD medication at least once in year 2013	Multiple logistic regression

Table 4.2 List of variables used in each study and their respective data sources

Study	Variables	Data source
II	Gender	**Denmark**: Danish Civil Registry, **Finland**: Medical Birth Register, **Iceland**: Birth Registry, **Sweden** Total Population Register
	Household income	**Denmark**: Danish Income Registry, **Iceland**: Tax Registry provided by Statistics Iceland, **Sweden**: Longitudinal Integration Database for Health Insurance and Labour Market studies (LISA)
	Maternal level of education	**Finland**: Medical Birth Register
	MMR1 vaccination	**Denmark**: National Danish Health Service Register, **Finland**: National Vaccination Register, **Iceland**: Vaccination Registry, **Sweden**: Data- base of statistics of the Child Health Care Unit in Uppsala
III	Maternal country of birth	New South Wales and Western Australia Birth Registers
	Aboriginal status	New South Wales and Western Australia Birth Registers
	Mother's age at birth	New South Wales and Western Australia Perinatal Data
	Social disadvantage	New South Wales and Western Australia Birth Registers
	Remoteness	New South Wales and Western Australia Birth Registers
	MMR1 vaccination	Australian Immunisation Register (AIR)
IV	Socioeconomic position	**England:** The Hospital Episode Statistics Admitted Patient Care Dataset, **Finland**: Medical Birth Register, **Ontario**: Marginalization Index (ON-Marg), **Scotland**: Scottish Index of Multiple Deprivation, **Sweden**: Longitudinal Integration Database for Health Insurance and Labour Market studies (LISA)
	Orchidopexy procedure	**England**: The Hospital Episode Statistics Admitted Patient Care Dataset, **Finland**: Care register for Health Care (hospital discharge), **Ontario**: Discharge Abstract Database (MOMBABY), **Scotland**: Scottish Morbidity Records, **Sweden**: The National Patient Register
V	Household income	Longitudinal Integration Database for Health Insurance and Labour Market studies (LISA)
	Parental country of birth	The Total Population Register
	ADHD Diagnosis	The National Patient Register
	ADHD Medication	The Prescribed Drug Register

4.6 Ethical considerations

Nationwide register-based research has the potential to give extensive information on the occurrence of health outcomes and the aetiology of diseases. This information can be used to assess the quality and effectiveness of healthcare, to plan preventive strategies, and to allocate resources in a better way. Despite the unique benefits of register-based research to society, some ethical considerations are raised due to the absence of personal consent and thus the possibility of infringing personal integrity. The problem of intrusion is avoided by anonymizing the data, namely by replacing all personal ID numbers with serial numbers that cannot be traced back to individuals by the researchers.

One must also consider whether the benefits of a study would outweigh the possible harm to an individual's integrity. In the studies in this thesis, the benefits outweigh the risks since the risk for individual harm is very low while the findings have the potential to lead to evidence-based policy changes that would benefit vulnerable groups such as children and the disadvantaged.

Since the thesis is composed of several international studies, a different set of ethical considerations had to be addressed in each case due to the requirements of different ethical boards. With the exception of the systematic review (Study I), all studies used register-based data and needed to be ethically approved. Table 4.3 describes the ethical permits obtained for each study.

Table 4.3 List of ethical permits for each study.

Study	Ethical Permits
I	Does not apply since the study is a systematic review of anonymized aggregated data, obtained from ethically approved studies.
II	**Iceland**: A national cohort from Iceland was created for this specific study by linking national register data at Statistics Iceland after approval by the National Bioethics Committee (Dnr:17-044-S1), and the Icelandic Data Protection Authority (2017010030; 11 May 2017). **Sweden**: The comparative study presented in this article was approved by the ethics committee in the Stockholm region (Dnr: 2018/2132-32). **Denmark**: Dnr: 2016-41-4576. Permit approved by Datatilsynet. **Finland**: No ethical permit was needed as only aggregated data were used.
III	Aboriginal Health and Medical Research Council New South Wales: 931/13 Western Australian Aboriginal Health Ethics Committee: HREC 459 Australian Institute of Health and Welfare: EC 2012/4/62 Australian Government/Department of Health and Ageing: 1/2013 NSW Population & Health Services Research Ethics Committee: HREC 13/CIPHS/15 Western Australia Human Research Ethics Committee (DOH HREC): 2012/75
IV	**England**: We have a data sharing agreement with National Health Service Digital to use a de-identified extract of Hospital Episode Statistics linked to Office for National Statistics death registration data; therefore, we did not require ethics approval to use English data sets. **Finland**: No study permission was required in Finland, since only aggregated data were provided for the study group. **Ontario**: The use of encoded Ontario data, accessed at ICES in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board. **Scotland**: Public Benefit and Privacy Panel for Health and Social Care (Reference No 1516-0405) and the Privacy Advisory Committee (No XRB13020). **Sweden**: The Swedish part of this study was approved by the Regional Ethics Committee in Stockholm in January) 2016 (Dnr: 2015/2113-31/5).
V	The study was approved by the ethics committee in the Stockholm region Dnr: 2015/2113-31/5

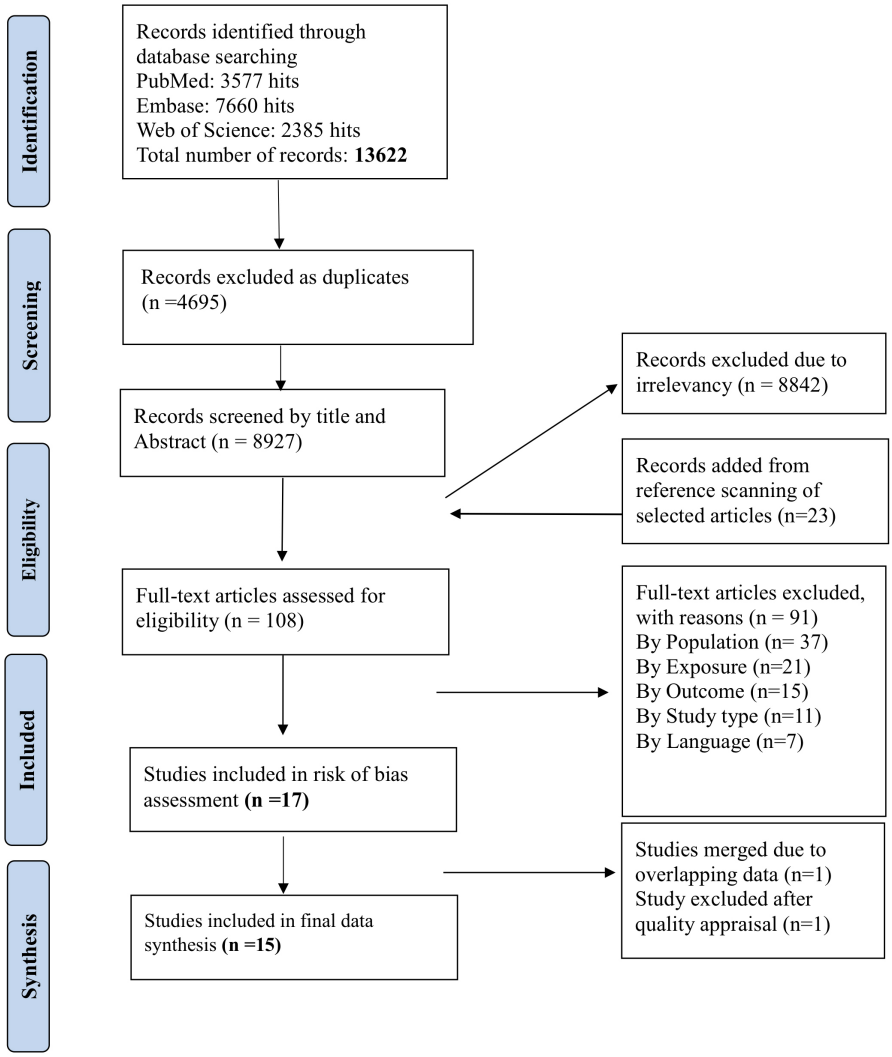


Figure 4.1 Flow chart of the systematic search process (following PRISMA guidelines).

5
Results

5.1 Social inequalities in vaccination uptake (Studies I, II, and III)

What is the socio-economic distribution of vaccination for infants and pre-school children in European countries and Australia?

In Study I, the systematic analysis of published literature showed that most of the European countries (7 out of the 11 countries included in the study) did not reach herd immunity levels for MMR and/or DTP vaccinations. Studies from Greece and France showed coverage levels as low as 63% and 40%, respectively. The studies in the review provided 21 results in total about socio-economic patterns of coverage. Among the 7 studies that showed socio-economic differences in coverage, there was no evidence of a gradient across the social groups but rather a gap between the most disadvantaged group and the rest of the population. The results from the studies were grouped at national level and the observed social distribution was analyzed through the lens of structure and organization of their healthcare systems. Results of this analysis are presented in the following sub-heading.

Study II compared the social distribution of MMR1 vaccination levels in four Nordic countries (Denmark, Finland, Iceland, and Sweden) and found Denmark to have the lowest levels of vaccination coverage with 82,2% and the largest social inequalities. In contrast to Study I, where Denmark was not represented, the results showed a gradient across the income groups: children of parents with lower income had lower vaccination coverage, with an absolute difference of 14 percentage points between the highest and lowest income quartiles. In the other three countries, there were smaller differences in MMR1 coverage across the social groups. In Finland and Sweden, the children of parents in the lowest socio-economic groups had an absolute difference of 1,4 and 4,1 percentage points, respectively, from the highest SES group. In Iceland, the two lowest income groups had lower coverage, with 4,8 percentage point difference between the highest and lowest socio-economic groups (Fig 5.1). It needs to be mentioned that in Denmark, socio-economic status is stratified into four groups and in the other three countries socio-economic status is presented in five groups.

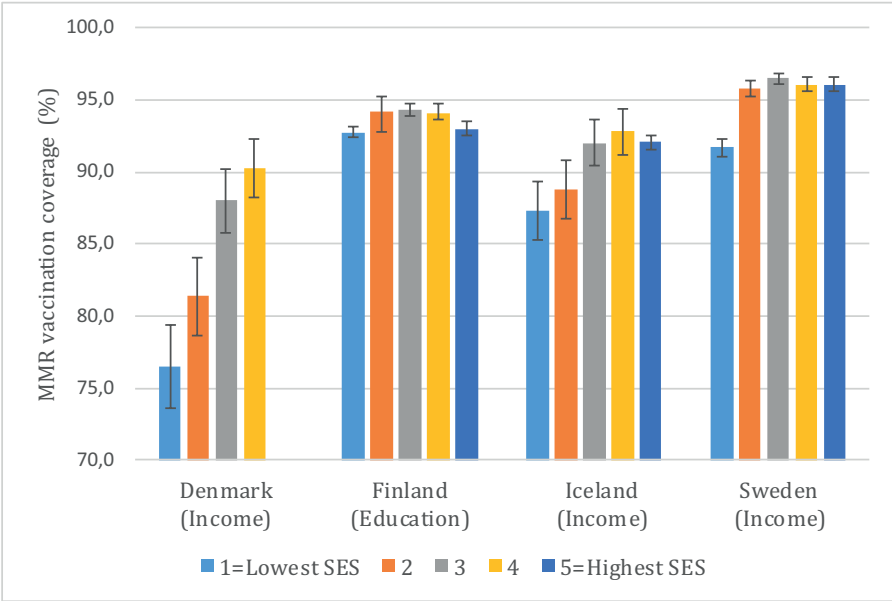


Figure 5.1 Distribution of MMR1 vaccination by socio-economic status in the four Nordic countries

Study III investigated the levels and social distribution of MMR1 vaccination in New South Wales (NSW) and Western Australia (WA) and showed 93% overall coverage in both states. Stratified analysis of the entire cohort born between 2002-2011 showed the largest social inequalities with respect to maternal country of birth and aboriginal status in both NSW and WA. Social inequalities in coverage by other indicators were less striking. In both states, the trends in coverage across Australian birth cohorts between 2002 and 2011 showed widening inequalities with respect to maternal country of birth, that is, whether the mother was born in Australia or born outside of Australia (Figure 5.2). A more detailed analysis of the maternal area of origin showed the compositional changes in the migrant group over time. In both states there was an increase in migrants from South Asia, which is a group with low vaccination coverage with declining figures in the last four birth cohorts. In WA, there was also a decline in the number of migrants from Europe, which is a group with relatively high vaccination coverage. Histograms and trends in coverage for each migrant group is provided in Appendix 1.

Inequalities in vaccination coverage by Aboriginal status declined over the years in both states. However, the improvement curve for the Aboriginal population was steeper and reached a higher level of coverage in NSW compared to WA (Figure 5.3). Across almost all socio-demographic indicators, children in the most disadvantaged groups had lower levels of coverage in WA than in NSW.

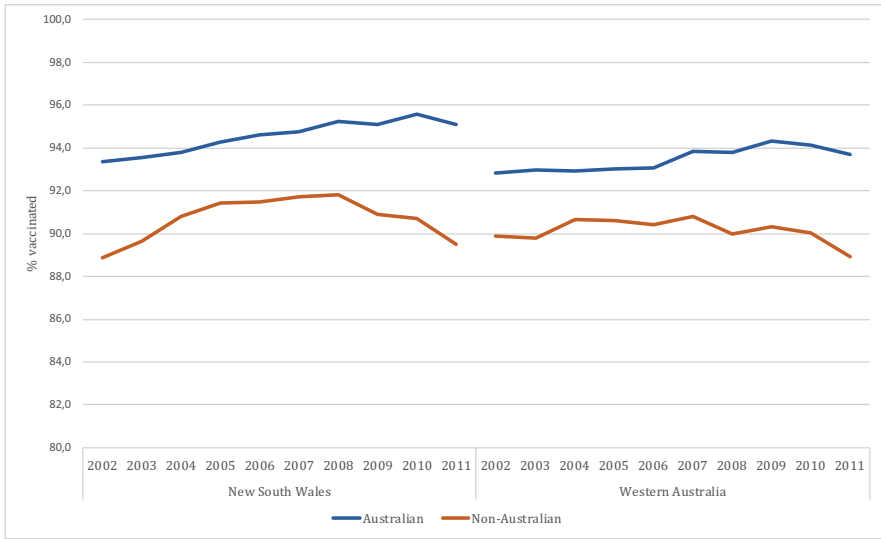


Figure 5.2 MMR1 vaccination coverage in NSW and WA by maternal country of birth

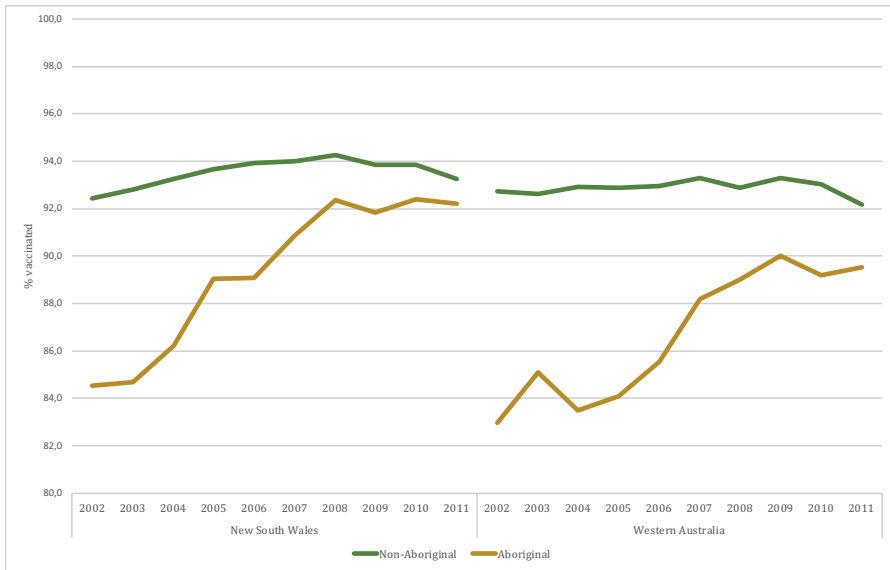


Figure 5.3 MMR1 vaccination coverage in NSW and WA by Aboriginal status

Does the socio-economic patterning vary in accordance with structural and organizational differences in child primary care across the countries?

This question was addressed methodologically only in Study I. In this systematic review, the included articles were grouped at the national level based on the structure of primary care (hierarchical vs. non-hierarchical) and the organization of child primary care (presence or absence of well-baby clinics). The results showed that vaccination coverage was the lowest and most unequal in countries where the primary healthcare system had a non-hierarchical structure and lacked well-baby clinics, such as in France and Greece. For example, a study from France (83) showed 33% and 42-46% of MMR vaccination uptake in farmers and other occupational groups, respectively. Similarly, a study from Greece (84) showed an overall coverage of 63%, with a 15% difference in vaccination uptake between children of parents with a high education level and parents with a low education level. Most of the results from countries that had well-baby clinics showed higher and more equitable vaccination coverage. For example, studies from Sweden and the Netherlands showed 93% and 95% vaccination coverage respectively, without significant socio-economic inequalities. This suggested a positive influence of the well-baby clinics on vaccination uptake.

Results from Study II were supportive of the findings from Study I. Denmark, the only country among the four Nordic countries without the well-baby clinics, showed lowest levels of vaccination coverage and widest social inequalities.

5.2 Social inequalities in the timing of orchidopexy (Study IV)

What was the proportion of orchidopexies performed by 1 and 3 years of age for birth cohorts between 2003 and 2011 in the five jurisdictions?

The results showed that Finland had the highest incidence of orchidopexy during the entire study period, followed by Sweden, England, Ontario (Canada), and Scotland. There was an increase in the number of cases in Finland from 80 per 10,000 live births in 2004 to 106 per 10,000 live births in 2011. In the case of Sweden, the numbers increased for the birth cohorts between 2003 and 2008, reaching a total of 96 cases per 10,000 live births before declining to 74 cases per 10,000 live births in the last birth cohort. The other three jurisdictions saw a steady trend throughout the study period, ranging from 60 to 70 cases per 10,000 live births.

Surgery before the age of 1 was less common than surgery before 3 years of age in all jurisdictions across the study period. Comparing the numbers at the beginning and at the end of the study period, there was an overall increase in surgeries

before the age of 1 across all jurisdictions. However, the size of this increase and its trend differed. In England and Ontario, the proportion of boys operated on before 1 year of age remained between 5-10%. In Scotland, there was a steep increase of surgeries from 15% in 2007 to 30% in 2009. For children born in Finland, a similar increase was observed between 2006 (8%) to 2009 (15%). In contrast to what we expected, Sweden was the only country with a decline in surgery before 1 year of age between the years 2007 and 2009, which coincides with a period of changes in policy recommendations about the age at operation. Sweden also stood out with respect to its trend in the proportion of boys operated on before the age of 3. While the other countries saw 80-90% surgery levels before the age of 3 across the study period, Sweden reached these levels only in 2006, with an initial level of 60% in 2003 (Fig 5.4).

What was the socio-economic distribution of orchidopexy by the age of 1 before and after the introduction of new guidelines in 2008?

An analysis of the inequality ratio for orchidopexy before 1 year of age showed a slight increase in absolute and relative inequalities across all jurisdictions after the introduction of new guidelines in 2008. When stratified by jurisdiction, we saw that boys born after 2008 in England and Scotland experienced the highest increase in inequalities. This was true in both relative and absolute terms. Although the inequality ratios for Sweden and Ontario did not change to a great extent, the differences became significant within each jurisdiction. In contrast to the other jurisdictions, there was a decline in the inequality ratio between the two time periods in Finland (Fig 5.5). Socio-economic inequalities in orchidopexy before the age of 3 were negligible both before and after 2008 in all five jurisdictions (Figure not included).

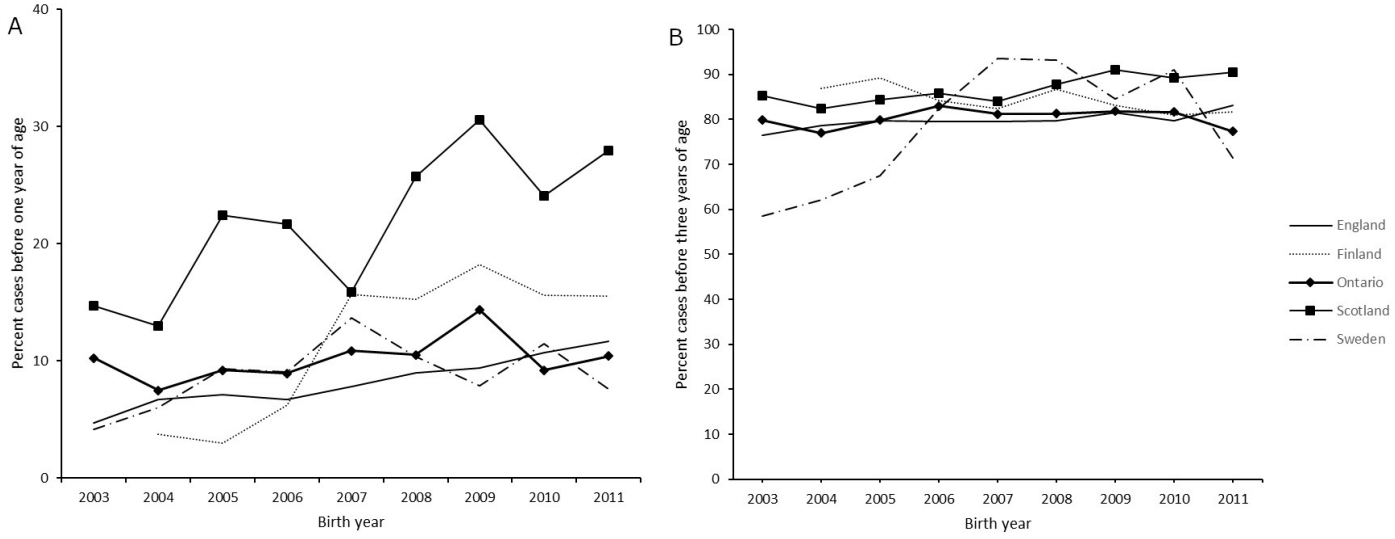


Figure 5.4 Proportion of orchidopexy performed by 1 year (A) and 3 years (B) of age

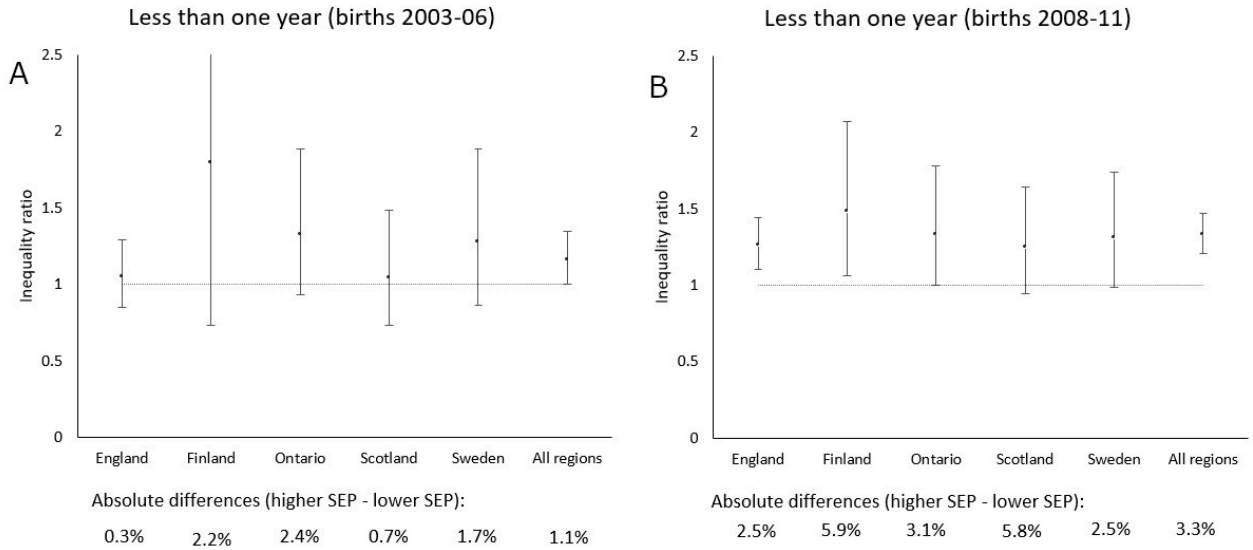


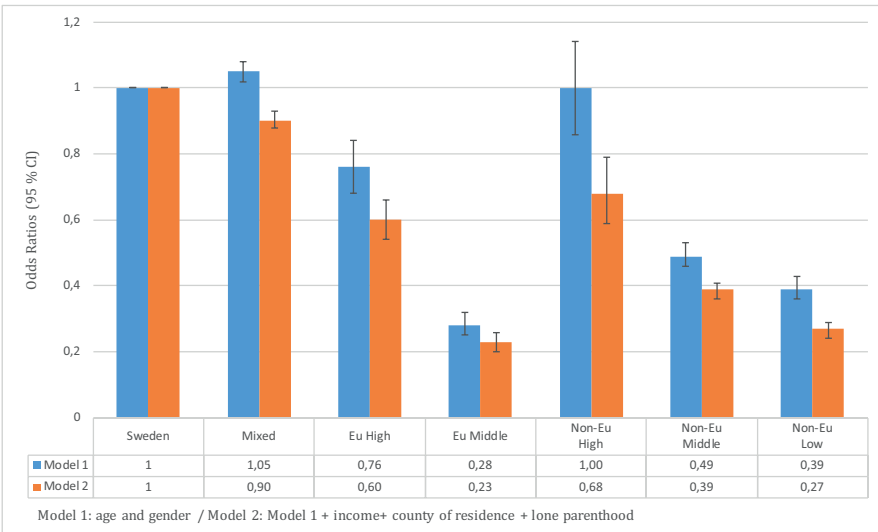
Figure 5.5 Inequality ratios for operation before 1 year of age in cohorts born before (A) and after (B) 2008.

5.3 Social inequalities in access to child and adolescent mental healthcare (Study V)

Is there an association between the income level of the parental country of origin and levels of ADHD medication among children in Sweden?

The results from Study V showed that, during the year 2013, 2.6% of children received ADHD medication at least once. It was also found that boys were more likely to retrieve medication compared to girls (3.7% versus 1.7%).

The results showed that parental country of origin is associated with the uptake of ADHD medication among children born in Sweden. Children of parents from low- and middle-income countries had substantially lower odds of retrieving ADHD medication compared to children of Swedish-born parents (Fig 5.6). In these social groups, there was a marginal change in the effect sizes when controlled for household income, county of residence, and lone parenthood.



	Sweden	Mixed	Eu High	Eu Middle	Non-Eu High	Non-Eu Middle	Non-Eu Low
Model 1	1	1,05	0,76	0,28	1,00	0,49	0,39
Model 2	1	0,90	0,60	0,23	0,68	0,39	0,27

Figure 5.6 Odds Ratios [OR (95%CI)] of ADHD medication dispensed.

Note on Fig 5.6: The Sweden category refers to children with two Swedish-born parents. The Mixed category refers to children with one Swedish- and one foreign-born parent. Rest of the categories are based on maternal country of birth. For ex. children with mothers from a high-income European country is placed in Eu High category.

To what extent is household income of relevance for this association?

There was a stepwise gradient of ADHD medication uptake across income quintiles for children whose parents were born in Sweden and for children whose parents were from mixed backgrounds. In these two social groups, children who live in high-income households were less likely to receive ADHD medication compared to households with lower income levels. This gradient was absent in all other migrant categories (Table 5.1). The results from the sensitivity analysis, with ADHD diagnosis as the outcome measure, showed similar patterns to ADHD medication retrieval.

Table 5.1 Odds Ratios (95%CI) for ADHD medication by household income within each immigrant category.

Parental country of birth	Lowest Income	2nd Income Quintile	3rd Income Quintile	4th Income Quintile	Highest Income
Sweden	1	0,88 (0,85-0,91)	0,74 (0,72-0,78)	0,65 (0,62-0,67)	0,51 (0,49-0,53)
Mixed	1	0,97 (0,88-1,06)	0,85 (0,78-0,94)	0,81 (0,74-0,89)	0,61 (0,56-0,67)
European high-income	1	0,99 (0,73-1,33)	1,07 (0,78-1,48)	1,06 (0,78-1,44)	0,78 (0,58-1,07)
European middle-income	1	0,98 (0,68-1,41)	1,12 (0,76-1,65)	1,23 (0,83-1,84)	0,73 (0,43-1,22)
Non-European high-income	1	1,16 (0,79-1,70)	1,06 (0,68-1,65)	1,18 (0,77-1,83)	0,89 (0,58-1,38)
Non-European middle-income	1	1,13 (0,95-1,35)	1,20 (0,96-1,50)	1,17 (0,92-1,50)	0,91 (0,70-1,19)
Non-European low-income	1	0,97 (0,77-1,23)	1,21 (0,92-1,60)	0,87 (0,62-1,23)	0,96 (0,70-1,34)

Note: Significant values are shown in bold.

6
Discussion

6.1 Summary of findings

Study I - There was a wide variety in MMR/DTP vaccination levels across the countries included in the systematic review. The results showed that in the countries that have well-baby clinics and hierarchical primary healthcare service structure, vaccination levels were higher and more equally distributed across social groups.

Study II - The results were supportive of the findings of the Study I. A comparison of the Nordic countries showed that Denmark had the lowest coverage and the highest social disparities in vaccination levels. Absence of well-baby clinics in Denmark seems to be one of the plausible reasons for this observed difference, since the other three countries have WBCs implemented in their child primary care services.

Study III - In both Western Australia and New South Wales, we observed social inequalities in MMR coverage with respect to maternal country of birth, maternal age at birth, and aboriginal status. Inequalities with respect to area of residence and area-level socioeconomic status were smaller. Overall, there was improvement in MMR1 coverage in both states over the period of interest to this study. However, vaccination levels in both states were consistently lower for children with mothers born overseas and for children from the Aboriginal population. The same is true for young mothers in Western Australia. Immunization strategy plans and interventions towards certain groups, such as the Aboriginal population, could be one of the explanations behind the decreasing gaps in vaccination levels in NSW.

Study IV - Proportions of orchidopexy performed before age 1 and 3 varied across the five jurisdictions. An analysis of the social distribution of the surgery before and after the introduction of new guidelines to perform the surgery before age of 1 showed an increase in inequality between high and low socio-economic groups in both relative and absolute terms. The relative increase was most prominent in Scotland and England, while the absolute increase was most prominent in Scotland, England, and Finland.

Study V – An analysis of access to Swedish mental healthcare services for children showed inequalities among some migrant groups. Children of parents from low- and middle-income non-EU countries had a lower uptake of ADHD medication. In families that had one Swedish and one foreign-born parent, as well as two Swedish-born parents, household income was influential on the levels of ADHD medication retrieval. Within these two groups, children of parents with higher socio-economic status had lower odds of receiving ADHD medication. For children of parents from low- and middle-income countries, there was no moderating effect of the household income.

6.2 Social inequalities in access to child healthcare

The dynamics behind the social distribution of uptake of healthcare services can be explored through the lens of Aday and Andersen's Social Behavioural Model (SBM) of access to healthcare services (34), as described in Chapter 2.

The role of income in vaccination uptake, one of the enabling factors in Aday and Andersen's model, is more relevant in countries where there is no universal access to healthcare services and where the parents are expected to pay for part of the services. The low vaccination coverage and striking differences between socio-economic groups observed in France is a good example of this case, supported by the findings in Study I. Lower income is also linked mostly to lower skilled jobs, which could result in greater hardship and a more stressful life. Such parents may not have the opportunity to prioritize the needs of the child in the long-term, such as seeking preventive services, due to the urgency of immediate needs such as food, housing, spending time with the child, etc. In most of the countries where there are no co-payments for the parents, the uptake of services was found to be more equitable with respect to income, which emphasizes the importance of free access.

In Study II, we observed income inequalities in MMR uptake in Denmark. However, the fact that child vaccinations are provided free of charge requires an explanation based on factors other than income. As discussed in the Background chapter, education and income are highly correlated dimensions of inequality and therefore the socio-economic gradient observed in this case could be a reflection of the role of parental education. This in line with one of the limitations of the SBM, namely its strict division between enabling factors such as income and predisposing factors such as education. One possible explanation for the relation between education and vaccination uptake might be the level of health literacy among parents. For example, higher education levels might result in greater awareness and knowledge of the need to vaccinate one's child due to exposure to health information. In addition, higher income could be indicative of better integration into the Danish job market in which social networks in the workplace could lead to parents acquiring further information about the child healthcare system. In the

other countries in Study II – Sweden, Finland, and Iceland – we observed fewer social inequalities in MMR vaccination uptake. We hypothesize that this is due to the structure and organization of primary preventive healthcare services, which I will discuss in the following section.

In Study III, we observed increasing inequalities in MMR1 uptake with respect to maternal country of origin and persisting lower coverage in the Aboriginal population. The inequalities observed in the first group (i.e. children with parents from a migrant background) could be due to the lack of vaccination services in the country of origin. This might be particularly pronounced in the growing population of migrants from south Asia, where vaccination levels are relatively low (85). Low levels of vaccination among migrant groups might be a reflection of both health beliefs derived from the country of origin and the lack of opportunities to access such preventive services in Australia. A comparison between NSW and WA showed differences in trends and size of inequalities. Possible reasons for these differences include policies around immunization and targeted intervention projects towards the Aboriginal population, which will be further discussed in the following section. An interesting observation was the decline in vaccination coverage, especially in WA, among children of the least disadvantaged parents. This observation is in line with a British study included in Study I that also showed an inverse socio-economic gradient based on parental education in relation to complete vaccination (86). One explanation behind this trend could be the rise of vaccine hesitancy among highly educated parents due to the spread of misinformation. However, it must be acknowledged that vaccine-hesitant parents could also come from diverse socio-economic backgrounds while sharing the same health beliefs such as anthroposophy (40) or they could have different attitudes towards vaccination due to their cultural beliefs (87, 88).

In Study IV, orchidopexy treatment was used as an indicator of both primary and secondary prevention. The choice of this indicator was important since the condition of undescended testicles is not expected to be socially distributed unequally. Therefore, any social differences in orchidopexy treatment was hypothesized to be a sign of inequalities in screening services in primary care or in the referral system to secondary care where orchidopexy is carried out. There were social inequalities in orchidopexy performed before the age of 1 but these inequalities disappeared by the age of 3. This might be explained by the fact that undescended testicles are detected later on in the child's life because the parents from a low socio-economic background may not be able to attend regular check-ups with the same frequency as parents from a higher socio-economic background due to time constraints, work obligations, and possibly the lack of such services. Another possible explanation might be that parents from a higher socio-economic status have typically higher health literacy and consequently go to check-ups more

regularly and demand faster services (38). This can lead to social inequalities in the referral process. Since we do not have data on waiting times between primary and secondary levels of care, we cannot reach a definitive answer on the basis of our study. But we can surmise that this hints at the potential importance of health literacy as a predisposing factor, in line with the SBM.

Study V showed the presence of inequalities in the uptake of mental healthcare services among children with parents born outside of Sweden. Parents may be less aware of mental healthcare services in Sweden if such services are less common in their country of origin (89). This lack of knowledge may affect parents' belief systems about mental health, expectations of child behaviour, and health-seeking behaviours (46, 90). This points to the importance of health beliefs in relation to the uptake of mental healthcare services. Sweden had equitable access in vaccination uptake in Studies I and II and relatively equal services in orchidopexy in pre-school aged children in Study IV. The disparity between the results in Studies I, II, and IV and the results in Study V highlights the importance of taking into account both the indicator of social position and the indicator of the uptake of healthcare services when analyzing and drawing conclusions about social inequalities in access to healthcare.

Study V was the only study where we observed gender differences in the outcome of interest. Previous studies on gender differences in ADHD diagnosis and medication have been mixed: while some have found similar levels of ADHD diagnosis and medication between boys and girls, others have found disparities between the two genders. Explanations behind this gender imbalance include differences in parental attitudes towards gender, which affect the parental help-seeking patterns; differences in how the disease expresses itself in each gender (e.g. girls have an inattentive and less disruptive subtype of ADHD) (23); and a referral bias in healthcare services (24, 25).

In the studies included in this thesis, we saw that not all countries showed inequalities in access to healthcare services. In several countries, such as Sweden and Finland, we found equity in the uptake of vaccination, as shown in Studies I and II. What factors could be leading to these observed outcomes of social equality in access to healthcare in these countries? Further, inequalities in the level of vaccination coverage as well as trends of vaccination level varied between NSW and WA, as shown in Study III. What is the reason for these variations across the two Australian states? The next section will try to address these questions with a focus on the role of healthcare service models in addressing inequalities in access to services.

6.3 The role of healthcare service model

As introduced in the Background, Diderchsen and Hallqvist's model (64) is useful for understanding how healthcare policies and healthcare structure could impact on the pathway from illness to health status. While the model provides insight into the way that curative services can positively affect patients' life chances, it understates the role of preventive healthcare services in reducing health inequalities. In the case of child healthcare services, a more equitable preventive healthcare is possible by making access to services less dependent on parental social position.

The structural and organizational factors that could lead to equitable preventive care are manifold (76, 91), although this thesis focused on three factors in particular: hierarchical vs. non-hierarchical organization of primary care, presence or absence of well-baby clinics within preventive services, and the vertical integration between levels of care.

In Study I, the role of hierarchical vs. non-hierarchical organization of primary care was examined. As mentioned earlier, we found that some of the countries with a non-hierarchical model had the lowest vaccination coverage and the highest social inequalities, such as in France. There are several reasons why this might be the case. First, in non-hierarchical models, the government has limited influence on how healthcare is financed and regulated at both regional and national levels (69). This means that services such as scheduled check-ups and parental call systems might not be implemented on a nation-wide level. As a result, access to these services could become more dependent on parental knowledge or self-initiative, which are closely linked to the social position of the parents. Second, in non-hierarchical models, the care provider has the freedom to open up their services in whichever geographical area they prefer, which leads to area-level inequalities. Socially disadvantaged areas, which are generally populated by low socio-economic households and migrants, tend to receive less service provision (92, 93). This means there are more patients per care giver and consequently less time allocated for each patient. As a result, the parents may not be able to communicate the full range of their medical needs and may also find it difficult to develop a trustful relationship with their care giver. Trust in the healthcare provider and services has been found to be positively associated with uptake of healthcare services (77, 94).

Studies I and II examined the role of well-baby clinics (WBCs). As mentioned previously, the presence of well-baby clinics correlates with a higher overall uptake of vaccination and lower social inequalities in vaccination uptake. This is particularly seen in the comparison between the four Nordic countries in Study II: Denmark, which is the only country without well-baby clinics among the four, stands out

with low levels of vaccination coverage and striking inequalities. Previous studies have highlighted similar inequalities in Denmark, both in the uptake of childhood vaccination (95) as well as in preventive screening services among children of parents with low income and a migrant background (96). These findings contrast to Sweden, where there are fewer inequalities in access to screening services (97, 98). WBCs are an example of a first-contact healthcare service, providing scheduled check-ups – including vaccinations – that can be easily followed by parents (72). Parents are sent reminders about scheduled check-ups by a parental call system, which increases the ease of accessing services and makes the visit to the WBC less dependent on parents knowing about these services or having to initiate contact with them. In WBCs, a specific nurse is assigned to a child from the neonatal stage to school entry. This encourages continuous communication between the nurse and the parents of the child. As a result, the parents can form a long-lasting trustful relationship with the nurse and discuss their concerns about vaccinations, which can help to counteract possible misinformation and hesitancy about the MMR vaccination (66). In addition, the nurse is able to keep track of the child's vaccination status over a period of years. In contrast to other healthcare systems where the care is given in segmented ways, healthcare systems with WBCs therefore facilitate a more holistic approach to the child's health and decrease the need for parents to communicate with different doctors depending on specific health needs (51). The findings in Studies I and II therefore support Starfield's model by highlighting the importance of primary care services as the first contact-point for parents to access healthcare as well as the role of longitudinality in providing a basis for stability and consistency in the provision in the healthcare.

Study III gave us the opportunity to observe the effects of policy changes and intervention projects on social inequalities in the uptake of healthcare services. The comparison in vaccination levels and trends between NSW and WA showed how immunization strategy documents and intervention projects reduced social inequalities in the uptake of vaccination. One such examples was the community-level intervention project for improving vaccination levels in the Aboriginal population (99, 100). Even though the program is targeted, it is still part of universal healthcare access and therefore can be considered as an example of what the Marmot review called "proportionate universalism", that is, the provision of universal services that are proportionate in their level to the intensity of disadvantage.

Study IV focused on the impact of a newly introduced recommendation about the timing of orchidopexy. As mentioned earlier, we observed an increase in social inequalities in surgery before the age of 1 after the recommendation was introduced. This increase in social inequality could be due to the fact that parents with a high socio-economic status were informed about the new recommendation earlier than parents with a low socio-economic status. The fact that high socio-economic

groups receive health-related improvements before low socio-economic groups – the so-called 'inverse equity hypothesis' – has been examined in previous studies (101). The previous section stated that parents with higher education levels might demand a faster referral due to their awareness of the recommendation to operate before the age of 1. However, the social inequality in surgery could also derive from the healthcare service provider. For example, it is possible that well-functioning healthcare clinics that keep track of new developments and recommendations may be located in socially advantaged areas, where there tend to be fewer patients per doctor and a higher quality of care (92).The observed inequalities in the age at operation could also be due to inequalities in referral between primary and secondary levels of care. This is explored in Starfield's four quality criteria framework, specifically the criterion of coordination (76). The ease of coordination between the levels of care (i.e. primary care and secondary care) implies strong vertical integration. The higher the integration, the less effort is needed from the parent's side to seek or receive information. Vertical integration makes the parent's experience less dependent on their opportunities for acquiring information about the healthcare system or their ability to navigate within the system.

6.4 Methodological considerations

The studies included in this thesis present themselves with strengths and limitations. Previous studies on vaccination coverage are mostly on survey-based data where the vaccination status is received by parental reporting. The use of register-based data sets minimizes the issue of selection bias, which is a common problem in observational studies that use other types of data. Therefore, the use of nation-wide electronic healthcare data that allowed linkage to social variables was a crucial strength of this thesis. Furthermore, the international comparative perspective that was implemented throughout the thesis increased the external validity of this work. Finally, the use of multiple indicators both for measuring social position and uptake of healthcare services gave us to opportunity to paint a richer and more detailed picture of the social inequalities in access to care.

As with all scientific work, the studies included in this thesis have several limitations. These limitations will be discussed below with an emphasis on validity.

6.4.1 Internal validity

Internal validity is concerned with minimizing the systematic errors and increasing the accuracy of inference (102). In this section, internal validity of the included studies will be presented through a discussion on information bias, selection bias and confounding.

Information bias

Information bias occurs when there is a systematic error in the measurement of information, leading to misclassification of study participants with respect to independent and dependent variables. The limitations regarding the operationalization and the measurement of main concepts (i.e. social position, healthcare uptake and healthcare service models) are discussed below.

Indicators of social position

As opposed to information obtained from the participants themselves, such as in the case of survey data, the use of registers minimises the potential misclassification in variables that indicate social position. These variables are typically defined at individual level such as the household income, parental level of education or parental occupation. However, in some registers the socio-economic variable is defined at area level, which might lead to misclassification of individuals with respect to their socio-economic position. This limitation was present in studies III and IV. In the latter, most of the countries had data on area-based socio-economic disadvantage measured in different ways, creating possibility for misclassification. However, this misclassification would be non-differential, which means that it would not be disproportionately distributed based on the vaccination (study III) or surgery status (Study IV) of the child. Therefore, this does not pose as much of a danger to the internal validity of the study.

This thesis had an international comparative perspective. A question can be raised about the validity of the comparative analysis in Study II and Study IV since the same concepts were measured by different indicators. For example, socio-economic position was operationalized in various ways both within and across the studies, mainly as either household income, relative deprivation, and/or educational level. In Study II, it was difficult to compare Finland to the rest of the countries because two measures of socio-economic position were used: 1) parental education in Finland and 2) household income in Sweden, Denmark and Iceland. Although the mechanisms behind the uptake of care in relation to educational background are different than household income, as discussed earlier in relation to Aday and Andersen's model (section 2.2.1), they are highly correlated. Similarly, in Study IV, one would ideally aim to compare the same indicators across all countries, but we were unable to do so due to data restrictions. While this may negatively affect the internal validity of the study, it does not undermine its findings.

Indicators of access to healthcare and equality

The use of national health care registers eliminated the issue of recall bias which is common in survey-based studies that use parental reporting in determining outcomes such as vaccination status, retrieval/use of medication, number of doctor

visits, etc. However, some of the studies included in the systematic review (Study I) were based on parental reporting, which could have decreased the internal validity of the studies due to misclassification in the outcome. Furthermore, certain social groups, such as socially disadvantaged parents, might be more prone to forgetting details of healthcare visits due to multiple layers of hardship in their lives. As a result, the vaccination status for the child might be misclassified. This is a type of differential misclassification endangers the internal validity of the studies included in Study I and therefore the validity of the review itself.

In addition, even though the focus of Study I was on MMR/DTP vaccination coverage, the systematic review included studies that analyzed complete vaccination. This means that a child who was classified in a study as not fully vaccinated (i.e. incomplete vaccination) could, however, be vaccinated against MMR/DTP. Although this may produce information bias, there is reason to assume that incomplete vaccination is due to the lack of uptake of MMR vaccination as a result of controversies around the vaccine.

Measuring social inequalities in access to healthcare requires information on the need for care across social groups. By looking at preventive services, we have tried to minimize the 'need' side of the story since we expect children from all social backgrounds to have same level of need. While this assumption holds for vaccination (Studies I, II, and III), it presents itself as problematic for Study V. In Study V, based on two studies from Sweden and England, we make the assumption that children of parents with migrant backgrounds and children of parents with non-migrant backgrounds have the same prevalence of ADHD. We therefore expected similar levels of preventative measures (i.e. ADHD medication) in both social groups. This assumption is a strong one which can be questioned.

Measuring social inequalities in access to healthcare through vaccination uptake requires an understanding about what percentage of difference can be considered as an inequality. However, there is no consensus on this matter. As a result, we used different approaches to inequality in Study I and Studies II and III. In the systematic review (Study I), we took an arbitrary cut-off point of 5 percent for determining inequality in coverage for the purpose of classifying studies in relation to types of primary care. In Studies II and III, we focused on describing the differences rather than creating a cut-off point to show broader patterns of inequality in coverage.

Healthcare service models

In this thesis we focused on three features of healthcare services: the presence or absence of well-baby clinics, having a hierarchical vs non-hierarchical model, and whether the services are integrated or not. These features gave us insight into possible explanations of how healthcare systems might influence the pathway from socio-

economic position to healthcare access. However, healthcare services contain other structural and organizational features that we did not take into account. For example, a more comprehensive model has been suggested by Kringos (91) including numerous indicators such as economic conditions of the primary care system (e.g. healthcare expenditure, remuneration system) and primary care workforce development (e.g. education and retention, professional associations). While these indicators are important, it was not feasible to address them within the scope of this thesis.

In Study III, there might be a misclassification of the area in which the child receives healthcare due to the parents migrating from one state to another within Australia. However, we assumed that the child does not emigrate from their state of birth during the first two years of their lives even though they may do. This possible misclassification is potentially problematic because the healthcare structure and the policies around vaccination might differ from one state to another, which are precisely the variables under analysis. Although this poses a risk to internal validity, one can assume that parents are less likely to migrate during the first year after the child's birth, which is the time when MMR vaccination is scheduled to be delivered.

Selection bias

In Studies II-V, we used register-based data, which does not rely on a self-selecting population. In this way we minimised selection bias, which is more common in survey-based studies. People who participate in surveys tend to share certain features, such as educational background, awareness of public health issues, and similar understandings of health, which means the data may not be representative. However, there is still some missing information in the register data, which might impact on the results. In particular, information on certain individuals was missing, leading to their exclusion from the main analysis.

The systematic review included studies that used survey data based on parental reporting of vaccination uptake. The selection bias within these studies might have biased the results of our systematic review. However, we tried to minimize this problem by analyzing and reporting the level of bias for each study included in our systematic review.

Confounding

In its simplest form, confounding occurs when an extraneous factor distorts the studied association between an exposure and an outcome. Studies with an ecological design could produce results that are due to the "ecological fallacy" (103), where individual-level outcomes are confounded by unknown factors at the population level. For example, Study II hypothesized that the differences in social inequalities in vaccination coverage between four Nordic countries are related to how preventive

care is organized (i.e. the presence or absence of well-baby clinics). However, other country-level factors might explain the observed results since our unit of analysis was the country, rather than the healthcare service structure or some direct measurement of it. In Study I, we tried to overcome this potential problem by grouping the results based on healthcare system structure and organization in each national context rather than by country. Furthermore, the presence or absence of well-baby clinics is a highly plausible explanation because previous studies show that services provided by this type of child healthcare unit leads to better child health outcomes (104, 105). Finally, the presence or absence of well-baby clinics is the main difference between the child healthcare services in the four Nordic countries.

6.4.2 External validity

External validity is concerned with generalizing the results to contexts that are beyond the scope of the studies. For a study that has high external validity, we would expect the results to be relevant for other countries. Therefore an international comparative study, such as this thesis, has higher external validity than a single country study. However, issues regarding external validity remain. For example, Studies I and II showed fewer social inequalities in vaccination coverage in the countries that have well-baby clinics. By the same token, the same studies showed more social inequalities in vaccination coverage in countries that lacked well-baby clinics. Yet there might be many other factors that could explain the observed inequalities that we did not take into account, thus limiting the external validity of Study I and II. Similarly, in Study III, the findings are country- and state-dependent. The policies that we assumed increase vaccination coverage in one state might not have the same effect in another state or another country. The results need to be interpreted with caution before implementing in other contexts.

6.5 Implications of findings and future research

This doctoral thesis aimed to add to knowledge about social inequalities in the uptake of different child healthcare services in Europe and Australia. Through the use of a systematic review (Study I) and empirical studies with individual-level data (Studies II-V), this project aimed to increase our understanding of what factors could lead to more equitable healthcare systems and services by adopting an international comparative perspective. It is rarely possible to create an analytical design which can be truly conclusive with research questions of this complexity. Contributions with a primarily descriptive aim, such as this thesis, can however provide valuable information for a more evidence-based discussion around social equality aspects of child healthcare. This thesis is in line with the Sustainable Development Goals (SDGs) set by the United Nations that aim, among other targets, to promote well-being for all and reduce inequalities within and among countries – with a particular emphasis on "leaving no one behind" (106).

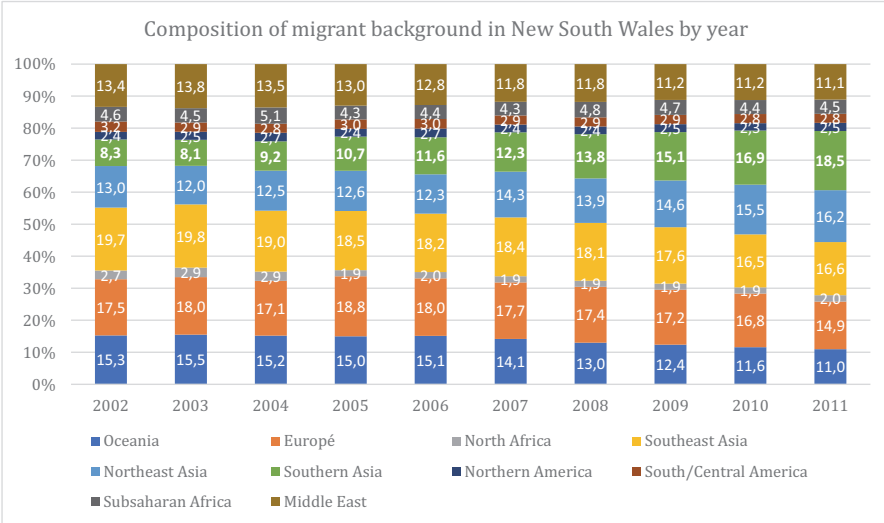
Our results from Study I, II and III indicated that strategies that can reduce social inequalities in vaccine uptake are important for reversing the current negative secular trends of vaccine uptake in many countries. This was especially true for study III in which we could study the trends in vaccination coverage over a nine-year period. These results suggest that more attention is needed in the area of social inequalities in vaccination coverage rather than only on vaccine-hesitant parents, as is the case in many countries now. There is also a need for more understanding of the interplay between vaccine-hesitant parents and social inequalities. A previous study has explored this interplay in Australia (107), which sheds light on where interventions are most needed. It would be useful to extend these insights in other countries.

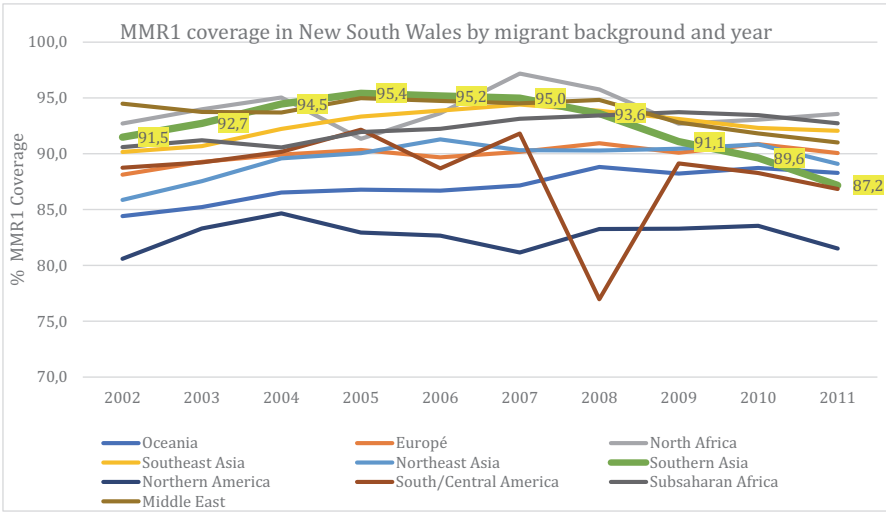
Study IV is an example of how the introduction of certain healthcare-related recommendations could lead to an increase in social inequalities. Within the structure of this study, it was not possible to determine where in the access continuum the inequality was created. Was it due to an increase in awareness of the changes of the new recommendations among parents from a high social-economic status? Or was it due to the fact that the recommendations were implemented in the healthcare units that are located in socially advantaged areas? To answer these questions more detailed research is needed which can assess change in behaviours, both among parents and the doctors in charge.

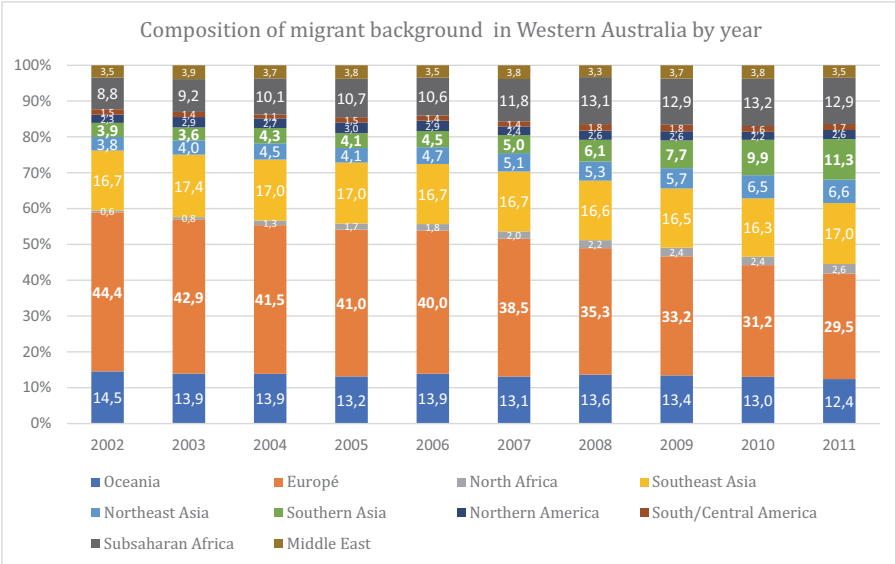
Study V suggested that social inequalities are present in access to mental healthcare services in Sweden among children of parents born in low- and middle-income countries. We suggest that this is due to a lack of knowledge and awareness among such parents about mental healthcare services, which are often absent in their country of origin. Further research is needed to find out how best to reach these parents to increase their knowledge and awareness of mental healthcare services in Sweden. Mental health is tightly connected to health beliefs, which are dependent on cultural and contextual factors. To have a deeper understanding of these issues in the context of barriers to access to healthcare services, we need qualitative studies that explore the ways in which parents perceive mental healthcare services.

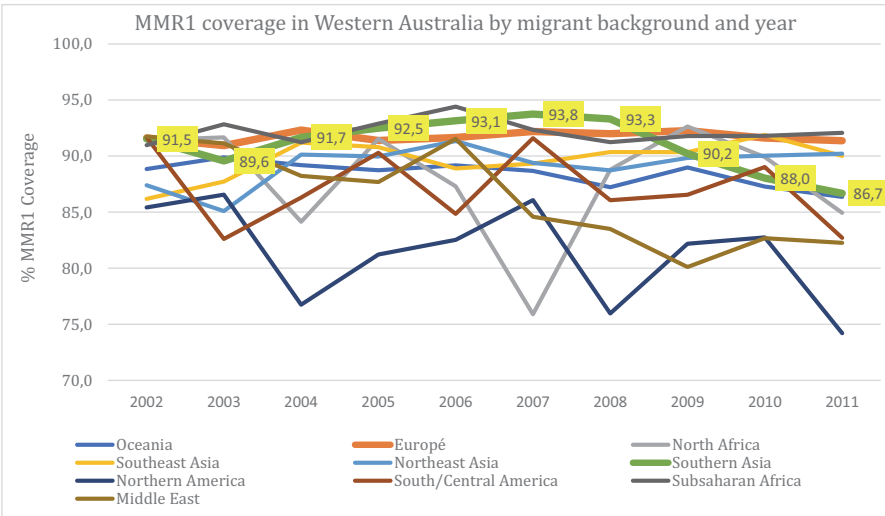
This thesis showed that register-based data is crucial for establishing linkages between healthcare outcomes and social variables. Future efforts are therefore needed to implement and improve national registers in all countries. This would facilitate further research that could provide a more nuanced and comprehensive picture of social inequalities in access to healthcare services on the national and international level. In addition, countries also need to arrive at a consensus about the indicators used to determine access to healthcare and socio-economic status in order to increase the comparability of the data.

Appendix


Composition of migrant background in New South Wales by year
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
13,4 13,8 13,5 13,0 12,8 11,8 11,8 11,2 11,2 11,1
4,6 4,5 5,1 4,3 4,4 4,3 4,8 4,7 4,4 4,5
3,2 2,9 2,8 3,0 3,0 2,9 2,9 2,9 2,8 2,8
2,4 2,5 2,7 2,4 2,7 2,4 2,4 2,5 2,3 2,5
8,3 8,1 9,2 10,7 11,6 12,3 13,8 15,1 16,9 18,5
13,0 12,0 12,5 12,6 12,3 14,3 13,9 14,6 15,5 16,2
19,7 19,8 19,0 18,5 18,2 18,4 18,1 17,6 16,5 16,6
2,7 2,9 2,9 1,9 2,0 1,9 1,9 1,9 1,9 2,0
17,5 18,0 17,1 18,8 18,0 17,7 17,4 17,2 16,8 14,9
15,3 15,5 15,2 15,0 15,1 14,1 13,0 12,4 11,6 11,0
Oceania
Europé
North Africa
Southeast Asia
Northeast Asia
Southern Asia
Northern America
South/Central America
Subsaharan Africa
Middle East


MMR1 coverage in New South Wales by migrant background and year
% MMR1 Coverage
100,0
95,0
90,0
85,0
80,0
75,0
70,0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
91,5
92,7
94,5
95,4
95,2
95,0
93,6
91,1
89,6
87,2
Oceania
Europé
North Africa
Southeast Asia
Northeast Asia
Southern Asia
Northern America
South/Central America
Subsaharan Africa
Middle East


Composition of migrant background in Western Australia by year
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Oceania
Europé
North Africa
Southeast Asia
Northeast Asia
Southern Asia
Northern America
South/Central America
Subsaharan Africa
Middle East


MMR1 coverage in Western Australia by migrant background and year
% MMR1 Coverage
100,0
95,0
90,0
85,0
80,0
75,0
70,0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
91,5
89,6
91,7
92,5
93,1
93,8
93,3
90,2
88,0
86,7
Oceania
Europé
North Africa
Southeast Asia
Northeast Asia
Southern Asia
Northern America
South/Central America
Subsaharan Africa
Middle East

Turkish abstract [Özet]

Avrupa ve diğer bölgelerdeki birçok ülkenin ortak hedefi olan evrensel sağlık hizmetleri çocuk sağlığı için büyük önem taşımaktadır. Evrensel sağlık kapsamında, her çocuk, sosyo-ekonomik koşullarına ve ulusal kökenine bakılmaksızın, ihtiyaç duyduğu sağlık hizmetini alabilmelidir. Hangi ülkelerin bu hedefe ne kadar ulaşabildikleri bu tezin ana temasını oluşturmaktadır.

Bu tez, çocuk sağlığı hizmetlerine erişimin sosyal örüntülerini incelemekte ve gözlemlenen sosyal eşitsizlikleri, sağlık sistemlerinin ulusal düzeydeki yapısal ve örgütsel farklılıkları açısından değerlendirmektedir. Bu tezi oluşturan çalışmalarda, koruyucu çocuk sağlığı hizmetlerinin birincil, ikincil ve üçüncül basamaklarına yönelik göstergeler kullanılmaktadır. Muhtelif ülkelerin ulusal veri tabanlarına dayanmakta olan bu tez, çocuk sağlığı hizmetlerindeki sosyal eşitsizliklere ilişkin uluslararası karşılaştırmalı bir bakış açısına sahiptir.

Tezdeki ilk üç çalışma, çocuklarda Kızamık-Kabakulak-Kızamıkçık (KKK) ve / veya Difteri-Tetanos-Boğmaca (DTB) aşılama alımının sosyal dağılımına odaklanmaktadır. Bir sistematik inceleme olan birinci çalışmanın sonuçları Avrupa ülkeleri ve Avusturalya'da farklı düzeyde eşitsizlikler bulunduğunu ortaya koymaktadır. Bu çalışmada yapılan sağlık sistemleri karşılaştırması, "sağlıklı bebek kliniği" hizmetine sahip ve hiyerarşik birincil basamak sağlık hizmeti yapısına sahip ülkelerin daha adil olma eğiliminde olduğunu göstermiştir. Tezin ikinci çalışmasından elde edilen bulgular, birinci çalışmanın sağlıklı bebek kliniklerine dair sonuçlarını desteklemektedir. Dört İskandinav ülkesi arasında yapılan karşılaştırma sonucunda Danimarka'nın KKK aşısı alınımında en düşük seviyelere ve en yüksek sosyal eşitsizliklere sahip olduğu ortaya çıkmıştır. İskandinav ülkelerinde çocuk sağlık sistemleri birçok açıdan birbirine benzerlik göstermektedir. Sağlık sistemleri arasındaki farklılıklardan biri olan sağlıklı bebek kliniklerinin Danimarka'da bulunmaması, gözlenen sosyal eşitsizliklerin olası bir açıklaması olarak öne çıkmaktadır. Tezin üçüncü çalışmasında, iki Avustralya eyaletinde (Yeni Güney Galler ve Batı Avustralya) KKK aşılamasının sosyal dağılımı incelenmiştir. Sonuçlar, her iki eyalette göçmen kökenli çocuklardaki KKK aşı seviyelerinin, göçmen kökenli olmayan çocuklara kıyasla, azalmakta olduğunu göstermiştir. Batı Avustralya'da yaşayan Aborijin çocuklarda hâlâ gözlemlenmekte olan KKK aşısı seviyesindeki eşitsizlikler Yeni Güney Galler'de büyük ölçüde aza indirgenmiştir. Aborijin nüfusu hedef alan iddialı aşı politikaları ve stratejik

müdahaleler, Yeni Güney Galler'deki azalan eşitsizliklerin olası bir açıklaması olarak görülmektedir.

Dördüncü çalışmada, orşiopeksinin (inmemiş testis ameliyatı) bir yaşından önce yapılmasını öneren Avrupa tavsiye kararı öncesi ve sonrasında, orşiopeksi zamanlamasının sosyal dağılımına odaklanılmıştır. Tavsiye kararı öncesi ve sonrasında bir yaşından önce yapılan ameliyatlardaki sosyal eşitsizliklerde hem mutlak hem de nispi artışlar gözlemlenmiştir.

Çalışma V, İsveç'teki çocuklar arasında Dikkat Eksikliği Hiperaktivite Bozukluğu'na (DEHB) yönelik ilaç alımının sosyal dağılımını konu almaktadır. Çalışmada, göçmen geçmişi olan ebeveynlerin çocukları ile İsveç doğumlu ebeveynlerin çocukları arasında karşılaştırma yapılmıştır. Analiz sonuçları, düşük ve orta gelirli Avrupalı olmayan ülkelerden gelen ebeveynlerin çocukları arasında daha düşük DEHB ilaç alınımı olduğunu göstermiştir.

Uluslararası karşılaştırmalı bir bakış açısına sahip olan bu tez, sistematik inceleme ve ulusal veri tabanlarına dayanan analizler yoluyla, çocuk sağlığı hizmetleri erişiminde devam eden sosyal eşitsizlikleri göstermektedir. Bu sosyal eşitsizliklerin büyüklüğü, ülkelerdeki çocuk sağlığı hizmetlerinin yapı ve organizasyonuna bağlı olarak farklılık göstermektedir. Bu bulgular, daha eşitlikçi bir sağlık sisteminin sağlayacağı potansiyele dikkat çekmekte ve refah devletlerinde, çocuk sağlığı hizmetlerinde reform yapılması ihtiyacına işaret etmektedir.

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